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Evaluating Naval Air Warfare Center Aircraft Division (NAWCAD) financial management practices in preparation for implementing ERP

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THESIS

EVALUATING NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION (NAWCAD) FINANCIAL MANAGEMENT PRACTICES IN PREPARATION FOR IMPLEMENTING ERP

by

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June 2000

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This thesis examines the current financial management processes in place at Naval Air Warfare Center Aircraft Division (NAWCAD) and the impact an implementation of an Enterprise Resource Planning (ERP) system would have on these processes. The Department of the Navy is committed to bringing current best business practices within its organizational structure in order to meet reduced budget guidelines. NAWCAD has embraced the best practices principle by changing their structure to a Competency Aligned Crganization (CAO). Currently, an ERP implementation is under consideration as another means to applying a current business practice that will make NAWCAD a more efficient and effective organization. The objective of this thesis was to evaluate the financial management processes and how ERP would affect them. Research on ERP definition and implementation in the private and public sector was conducted. Interviews with NAWCAD financial management managers and analysts were used to compare and contrast the current processes in place with those processes that would be developed as the result of implementing ERP. This thesis is part one of a two-part study. Part one provides the necessary background for a follow-up study that will examine the financial management system used by NAWCAD after ERP is implemented.

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I. INTRODUCTION

A. BACKGROUND

The Secretary of Defense stated in his 1997 Defense Reform Initiative, " DoD has labored under support systems that are at least a generation out of step with modern, corporate America...DoD support systems and practices were developed in their own defense-unique culture and never corresponded with the best practices of the private sector" (DoD, 1999). Under the Department of the Navy's (DoN) Revolution in Business Affairs, a commitment to eliminate outdated Cold War business practices is being put forth. One initiative, currently being reviewed by the Commercial Business Practices Working Group is the use of Enterprise Resource Planning or ERP as a means of investing in new business strategies. This working group is conducting several pilot projects to prove the effectiveness of ERP in facilitating process re-engineering (DoN, Working Group Charter, 1999).

After computers were introduced into business operations, information systems were developed to meet the challenges of corporate growth. Initially, Management Information Systems (MIS) were proposed as a solution. As computers became more powerful and cheaper than their predecessors, management-oriented software based on organizational information problems became available. Executive Information Systems (EIS), Material Resource Planning (MRP), and Manufacturing Resource Planning (MRP II) are examples of management-oriented software. The latest planning tool that can be added to the list is ERP.

ERP is designed to make businesses run efficiently. However, ERP must be implemented as a package. That package consists of both ERP software as an enabler and corporate support within the organization. Internal support is probably 80 percent of the effort required for successful implementation (Flinn, 1999). The key steps in implementing ERP are:

- Study the current system in use.
- Define organization structure and procedures.
- Design and develop a replacement system.
- Acquire and customize ERP software.
- Educate and train employees.
- Implement the new system.

Naval Air Warfare Center Aircraft Division (NAWCAD), while not one of the pilot projects mentioned above, is interested in the potential opportunities of ERP implementation within the command. NAWCAD is the Navy's research, development, test and evaluation, engineering and fleet support center for air platforms (NAWCAD, 1999). NAWCAD is expanding their existing business base from primarily military and Department of Defense (DoD) work to applications within the private industry. With an understanding of the value of an expanding customer base, NAWCAD is promoting the concept of a successful business process. That process, which could be ERP based, is also a process that NAWCAD intends to use to create satisfied customers (NAWCAD, 1999).

B. PURPOSE

Navy Echelon III commands such as NAWCAD use outdated and inefficient business practices. In contrast, similar sized corporations rely on management techniques based on current information technology and the management systems that accompany them (Reyelts, 1999). This thesis examines the management techniques and business practices used with a new management process - Enterprise Resource Planning. This thesis also reviews the current management system (with emphasis on financial management) at NAWCAD for ERP compatibility in terms of feasibility and support.

C. RESEARCH QUESTIONS

1. Primary

What are the existing financial management processes currently used at NAWCAD that could be incorporated in implementing ERP?

2. Secondary

- What are the major drivers for implementing ERP?
- Will there be any major impediments to implementing ERP?
- What processes are involved with ERP formulation and implementation?
- How can NAWCAD benefit from ERP case studies on commercial firms?

D. EXPECTED BENEFITS OF STUDY

Studying ERP implementation at NAWCAD is a two-part process. This thesis (Part I) evaluates ERP and its application to the business process within NAWCAD. Part I also examines the current financial processes involved in implementing ERP at NAWCAD. Part II

(accomplished through later research) will determine the success of ERP and whether it directly supports the business goals of NAWCAD.

II. BACKGROUND

A. DEFINING ERP

ERP is a relatively new term to the technology industry. The E for enterprise connotes that the core functions consist of information technology (IT) applications that have an organization-wide affect. The R for resource implies that the applications concern the management of financial as well as non-financial resources. The P for planning suggests that the system focuses on the organizations improving their strategic decision-making as a whole. The origin of P stems from the origin of ERP systems in the manufacturing industry where inventory control and production is the main focus. (Rowan, 1999)

ERP systems consist of software applications that provide organizations with the capability to manage their core business processes. These systems differ from previous generations of software primarily because ERP relies on a common database for both financial and non-financial applications that are accessible on a real-time basis. Also, ERP software consists of a process view (not functional view) of the enterprise, which allows organizations to adopt best business practices and redesign existing processes as they implement new software-based modules (Rowan, 1999). Rowan's (1999) definition of ERP is summed up by stating, "Sociologists studying organizations long ago discovered that information is power; ERP systems implicitly recognize that consistent, reliable and timely information is 'power squared'."

B. HISTORY OF ERP

In the 1960s, computers were first introduced into the manufacturing process as a means to plan for the use of materials and production requirements. The term identifying this process was material requirements planning (MRP). Before MRP, normal business practices revolved around maintenance of an inventory system that reacted to customer demand. Any change in demand required recalculation and analysis. Working with rudimentary calculating machines, manufacturers followed a lengthy planning process to adjust to the new demand (Ptak and Schragenheim, 1999). Before MRP, inventory was an asset available to the customer and as long as the supply never ran out, a company was following accepted standard procedures. As inventory forecasting became an issue in asset management, MRP was introduced as a means to manage material in a way that allowed managers to be proactive rather than reactive. For the first time material planning functions could answer the question of "when" instead of waiting until a shortage occurred.

During the 1960s and 1970s, MRP and the accompanying tools and techniques were beginning to be understood and began to show benefits for the manufacturing operations that implemented it well. Material requirements could now be calculated to assist in capacity planning. (Ptak and Schragenheim, 1999)

In the 1980s, as technology improved, an integrated system combining inventory control and financial activity was introduced as MRP II or Manufacturing Resource Planning. MRP II closed the loop on the financial management of a company allowing their resources to be planned and controlled. For the first time an organization could have an integrated business system providing visibility of the requirements of material and capacity driven from a

desired operations plan (Ptak and Schragenheim, 1999). This organization could take advantage of MRP II's ability to allow input of detailed activities and translate them to a financial statement. If there were problems in accomplishing the desired plan, then suggested actions would address those issues. MRP II was in reality a closed-loop communication system that simultaneously reduced inventories while improving customer service (Martin, 1995). Organizations realized that to be competitive there was a requirement for this centralized communications system.

In the 1980s and early 1990s Just in Time (JIT) became an industry practice, as customers demanded delivery of products on their terms and manufacturers sought to simultaneously meet the demand and reduce the amount of capital tied up in inventory. Partnerships between suppliers and manufacturers were developed as a means to remain competitive.

As JIT was developing, the cost of goods sold was shifting from labor to material. In the 1940s and 1950s, labor costs contributed 40 to 60 percent of cost of goods sold. In the 1990s, labor made up 10 to 20 percent of cost of goods sold with material being 60 to 70 percent of costs. Improving labor productivity would yield minimum benefit in a company's profit. In order to improve an enterprises financial performance, planning shifted to a material-based optimization. Financial improvements in material utilization would yield big returns in an era when carrying extra inventory was no longer a practical business practice. (Ptak and Schragenheim, 1999)

As the 1990s approached, the cost of technology declined and the personal computer was revolutionizing business management systems. Fully integrated MRP II systems were

now able to run on a desktop computer and a new client-server technology replacing large mainframe systems. The costs of systems now made integration solutions available to even the smallest companies. As companies moved away from the mainframe systems to the client-server systems, newly formed software companies were beginning to develop and provide enterprise resource planning or ERP software and solutions based around client-sever technology.

C. EVOLUTION OF ERP

Management uses different language than information system staff and, therefore, there is often a lack of understanding of both the managerial needs and the capabilities of the information system to supply the need (Ptak and Schragenheim, 1999). ERP is able to bridge the gap by providing a mutual understanding of the support that management requires from information systems.

Information technology (IT) has developed in continual increments during the last 20 years. This development is largely based on technology -- as computer's processing speed increased, software became more complex and provided more solutions. Management thinking has undergone a transformation as well. One example, developed in the early 1980s, is the management philosophy Total Quality Management (TQM). Although not promoted today as much as it was during the 1980s, "quality" is now more important than it has ever been. ERP can provide a link between the management techniques, such as TQM, and the information system technology. The real value of ERP to organizations lies in the term "enterprise." From a top management view, the idea of ERP is much greater than the technology to provide an efficient client-server environment and a common database, of

which both support improved accuracy and availability of information. For management, ERP may provide a tool to unite the various functions within the organization into a whole effective organization striving to achieve a common goal with the same level of resources. Understanding the managerial ideas behind this philosophy of treating the organization as one system, the need for ERP becomes clear and provides the link between management and information system technology. (Ptak and Schragenheim, 1999)

ERP has evolved into a systematic application enabling an organization to adapt to new technologies and optimize processes by integrating core processes across organizational and functional boundaries (Reyvelts, 1999). One objective of management is to treat the organization as a singular system. Ptak and Schragenheim (1999) write:

> The real value of ERP to organizations lies in the term "enterprise." From the top management view, the idea of ERP is much greater than the technology to provide an efficient client-server environment and a common database, both of which support improved accuracy and fast availability of information. For top management, the new ERP packages may provide a tool to unite the different functions within the organization into a whole effective organization striving to achieve the common goal with the same level of resources.

D. FIVE STAGES OF ERP IMPLEMENTATION

Implementing ERP into a company is a complex and costly project. Cost for implementing ERP can range from $500,000 to $130 million and it can often produce gut-wrenching organizational change that can be long and arduous (Ross, 1999). Therefore, successful implementation is critical considering the investment. ERP implementation consists of five stages starting with design, then implementation, stabilization, continuous improvement and ending with transformation.

1. Design

All ERP packages provide choices on how to configure the software, but they also make some assumptions about data flow through the business processes. During the design, a decision has to be made on whether to accept these assumptions. This is different from traditional systems development in which you decide on processes and then build systems to support them (Ross, 1999).

Management sometimes resists the process changes ERP requires. They may want to change their IT systems but not their organizational processes. But, process change is inevitable with ERP because the organization has to fit around the software in order for it to succeed. Therefore, process standardization is a key design decision. Management must decide whether to standardize across geographic or product lines or business units. Using the same software will not lead to common processes unless the implementation process is designed to ensure that the same model is implemented organization-wide. This standardization must be determined before the implementation process begins, because it is difficult to make changes after ERP is in place. (Ross, 1999)

2. Implementation

Companies will face decisions in process change involving divisions, plants, and functionally oriented departments as part of their organizational makeup. The design of ERP systems is to provide an integrated view of the world requiring cross-functional activity throughout the organization. This cross-functional nature drives the need for collaborative teams of individuals to make critical decisions. Add in global project-management issues and you now have a challenging situation. The risk lies in shifting implementation objectives,

stalled projects, and compartmentalized business functions that defeat the integrated whole to which organizations strive. These issues are addressed with the use of consulting firms specializing in change management within ERP. Today's implementations are becoming more prone to success than failure because ERP vendors partner with consulting firms for implementation services. (Caruso, 1999)

Careful planning and training will not guarantee the lack of disruptions within an organization during ERP implementation. Do not expect to implement the system and then go on as if business was back to normal. Because ERP implementation is expensive, management tends to declare victory and move on to other business concerns. But, a post-implementation stage must be included to provide an opportunity to redesign and re-engineer processes to make them compatible with ERP. These changes could be viewed as hurting the organization in the short run. For example, processes previously automated might become manual while ERP is implemented, which could increase resources and labor costs. Patience is necessary during the disruption as organizations go live with ERP. (Ross, 1999)

3. Stabilization

When implementing ERP, expect a decrease in performance to last four to 12 months (Ross, 1999). During stabilization, there is an opportunity to better understand the processes occurring within an organization to obtain better information. This time can be used to train new users of business processes, and work with vendors and consultants to work the bugs out of the system. Firms described this period as disaster filled. Despite efforts ensuring a clean implementation, unexpected system failures and difficulty in adjusting to new processes often lend themselves to horrific anecdotes. For example, Whirlpool Corporation and Hershey

Foods experienced glitches in their distribution process that affected not only themselves, but their distributors as well (Boudette, 1999).

4. Continuous Improvement

During this stage, an increase in functionality can be expected by adding improvements such as bar coding, warehousing capabilities, sales automation and forecasting. ERP can generate significant operating benefits such as inventory reduction, improved order fill rates, and reduced logistics.

This is also the time for process redesign and implementing new structures. Organizations may add new process teams to their corporate structure to ensure process integrity and identify opportunities for process change. Most importantly, an on-going effort to instill discipline in the organization and to continuously improve processes can be derived from ERP. (Ross, 1999)

5. Transformation

ERP offers the opportunity during the transformation stage to become customer and process oriented or take an entirely new approach to organizational decision-making. One way firms try to transform themselves is by changing organizational boundaries. Companies now focus on offering combinations of products and services to meet their customers' needs. For example, General Electric, once known for its electrical products is now involved in capital lending and leasing capabilities. In the past, companies sold what they wanted to make, but to compete in a global economy; they need to provide the product and services their customers want.

Companies that progress to continuous improvement and transformation demonstrate their commitment to ERP by:

- Assigning their best people to the project 100 percent of the time.
- Develop a clear business case clarifying performance objectives.
- Demanding regular reports based on established metrics.
- Communicating goals and establishing program scope.
- Establishing a long-term vision. (Ross, 1999)

E. DESCRIPTION OF SPECIFIC ERP INITIATIVES

Companies are radically changing their information technology strategies by purchasing prepackaged software instead of developing IT systems in-house. Specifically, businesses are replacing their legacy systems with ERP systems (Holland and Light, 1999). In 1999, businesses spent an estimated $20 billion implementing ERP systems to automate key back-office business processes and gain a competitive advantage in a global market (Knorr, 1999). Examples of firms that have implemented ERP systems include: McDonnell Aircraft and Missile Systems, General Electric, Coca Cola, Ericsson, Hershey, IBM, and BP/Amoco (Reyelts,1999).

1. McDonnell Aircraft and Missile Systems

In September 1997, McDonnell Aircraft and Missile Systems, part of The Boeing Company, went live with an ERP-based system. What make this implementation significant are the facility's size, the project's magnitude and the product's complexity. With 20,000 employees in a 10 million square foot facility, Boeing's Saint Louis manufacturing facility is one of the largest manufacturing plants in the world. (Womeldorf, 1998)

Due to the shrinking defense budgets, Boeing felt it necessary to undertake this project to produce aircraft and missiles at a relatively low cost. Boeing's goal was to improve return-on-investment (ROI) in order to maintain industry leadership (Womeldorf, 1998). Not only did they want to bring their performance in-line with their competitors, they also wanted to gain a significant leverage in the military aircraft industry by using advanced information technologies to streamline their business processes. The Saint Louis facility had been using production and material control systems dating back to the 1960s. In fact, Saint Louis was one of the few major airframe production facilities to never have implemented a Manufacturing Resource Planning (MRP II) system. By implementing ERP, Boeing focused on applying industry best practices in product definition, resources planning, and production management. Information from these practices would then be used to determine their effects on business acquisition, program management, supplier management and post-delivery processes.

Starting in 1995, Boeing, using off-the-shelf ERP software and a client-server system, began their pilot testing. In April 1996, their billing system was converted to the new system, based on the ERP software - Integrated Manufacturing Control Systems (IMACS). In 1997, a simplified version of IMACS went live to support a missile system production and the production of T-45 aircraft (Womeldorf, 1998).

McDonnell using a process-based methodology, documented all key processes and then applied best practices with their ERP implementation. As a result, operation-based improvements were being realized on a daily basis. For example, training packages developed for new processes certification saved Boeing more than $250,000 over previous approaches.

Material planning controlled supply and demand at every level allowing better visibility of work-in-process inventory. For example, assembly orders are released only when material, tools, and capacity are available. Also, administrative lead times for purchasing orders and releasing work orders have been reduced and continue as those involved become comfortable with the system. (Womeldorf, 1998)

Improvements are being realized in terms of cost management. Boeing now has cost visibility at the individual part level based on automatic cost capture from the operational IMACS transactions. In fact, the IMACS parts costing system is being implemented throughout every Boeing McDonnell Aircraft and Missile Systems site as a common tool for identifying cost drivers, improving operational efficiency and lowering production costs. (Womeldorf, 1998)

Similarities exist between Boeing's McDonnell Aircraft and Missile System and NAWCAD. Both organizations are similar in terms of product output and the research and development necessary for it to occur. IMACS represents the type of technology that is compatible with NAWCAD processes. IMACS ability to streamline the complex military aircraft production environment will provide the DoN with similar solutions for similar processes.

2. Coca-Cola

Coca-Cola (Coke) is facing the toughest business conditions it has seen in years, and is relying on several major IT initiatives to help stay ahead of their competitors well into the new century. The company's strategy revolves around use of SAP ERP software. Coke is including their bottling partners, which are independent companies, in their implementation,

resulting in an extension of their enterprise. Coke's goal is to lower costs across the enterprise and allow itself and their bottling partners to share best practices, pool resources and leverage their combined size to get better deals on IT systems and raw materials. (Violino, 1999)

Because the bottling companies are independent, Coke had to convince them to buy-in to the ERP solution. Once convinced, Coke signed a contract with SAP in June of 1996, and the first phase of ERP implementation began in spring of 1999. The project, a seven-year strategic plan dubbed Project Infinity, included 11 anchor-bottling partners that account for 43 percent of the company's total worldwide volume. Initial implementation included the ERP modules for financial, purchasing, human resources management and project management applications. The full suite will include production and material management and project management applications. Currently, running ahead of schedule and under projected costs, SAP's ERP system is exceeding original expectations. (Violino, 1999)

Coke senior management has stated ERP will speed supply process management, forecasting and production planning. Coke also expressed expectations that several marketing benefits from ERP. Coke has saod that it hopes to boost sales by having the ability to analyze a complete and accurate sales information picture (Violino, 1999). The company now gets price and quantity information from invoices, rather than a summary statement, which was of limited value. Coke using ERP can now compare and determine whether promotions and advertisements are meeting goals by region and by store (Reyelts, 1999).

Reyelts (1999) cites Coke as an example that DoN can follow for their ERP implementation. Just as Coke gained a strategic advantage with the buy-in from its

independent bottlers, the DoN could gain buy-in from those Navy commands selected to implement ERP in pilot programs (Reyelts, 1999). By proving the effectiveness of ERP on the following focus areas: acquisition program management, aviation supply chain/maintenance management, regional maintenance and warfare center management, the Navy could implement ERP service-wide based on pilot results and projected return on investment.

3. Novell – Oracle Solution

Novell is another private firm that successfully implemented ERP and from whom the Navy would likely benefit by studying their ERP solution. Implemented in March 1998, Novell applied Oracle's Internet Procurement application for the purchasing of their nonproduction goods (identified as maintenance, repair and operations [MRO]) and services. ERP now allows Novell to order 80 percent of its MRO supplies online. About 1300 Novell employees currently submit purchase requisitions online, allowing Novell to reduce the cost of processing a purchase order from $120 to $50. Novell is currently expanding its manufacturing operations in the same manner. (Reyelts, 1999)

NAWCAD could benefit from this type of ERP solution within its comptroller department. Currently, NAWCAD is charged $16.77 per invoice line by DISA, a processing accounting center based in San Antonio, Texas (Foley, 2000). By implementing a procurement module similar to Oracle's package, NAWCAD and the DoN could also realize a 40 percent savings in purchasing invoice processing.

4. Summary of Commercial ERP Implementations

The preceding examples illustrate how ERP has helped those companies replace outdated back-office systems and integrated their enterprises with modules controlling functions such as financial accounting, manufacturing control and inventory management. The following section reviews governmental implementations of ERP.

F. GOVERNMENT BEST PRACTICES

The Information Technology Management Reform Act (IMTRA) of 1996 requires, on a continuing basis, an assessment of the experiences of agencies, government entities, international organizations and private sector in managing information technology (Reyelts, 1999). This section looks at government organizations that decided ERP can provide the type of business solutions they require.

1. United States Mint

In October 1998, The United States Mint went live with PeopleSoft's complete suite of products that replaced their financial management and order tracking systems. The Mint manufactures all U.S. coins as currency. However, half its sales are of related products such as commemorative coins and other collectable products (Varon, 1998). Mint director Phillip Diehl commented "the lack of reliable access to even rearview-mirror information has been one of my biggest frustrations" and there is "very little hard information about what the real cost factors were" in the collectible business (Varon, 1998). COINS (COnsolodated INformation System) was the ERP solution designed to alleviate this problem. The Mint is the only government agency that purchased the complete set of commercial –off-the-shelf (COTS) PeopleSoft applications designed for use as a full-scale Federal ERP system. COINS

will enable the Mint to improve customer service and make better management decisions. The system is being used by 1,200 employees at six locations and is expected to cost $40 million over a 10-year life cycle. The ERP project allowed the Mint to eliminate their legacy systems and meet the Office of Management and Budget (OMB) deadlines for Y2K. (Varon, 1998)

2. The State of Montana

In the 1990s, government managers in Montana concerned about the Y2K problem spent $16.5 million for hardware, software and consulting fees to implement an ERP system. The first phase, budget development, went "live" in August 1998, with asset management going live two months later. In May 1999, the State was able to pay its 12,000 employees from their human resources module (Perlman, 1999). Prior to using ERP, Montana officials had to rely on independent computer systems whose data were incompatible with each other's. Perlman (1999) cites the process Montana used to purchase State vehicles. Each agency involved in the purchasing process (there were three) relied on their legacy system to conduct their portion of the purchase. They did not share the information they had and at times it was often conflicting. The use of software from PeopleSoft eliminated these problems by allowing the different agencies to exchange and use similar data resulting in reduced data entries and reduced errors. Montana also benefited from ERP because each State agency's employees developed skills easily transferable between agencies.

ERP implementation requires an investigation into a government's business processes. It takes the average governmental organization about a year from when the analysis begins to when a decision to implement ERP is made (Perlman, 1999). There are two ways to proceed:

the "rich man's" and a "poor man's " approach. Under the rich man's approach, the ERP project is funded to hire consultants full-time to implement and contractors to run the system. The poor's man approach uses governmental employees as much as possible to implement the system, maintain it and train other employees. The advantage over the poor man's approach is government employees are not burdened with performing their regular job along with additional implementation duties. The advantage of the poor man's approach is two-fold: cost savings and employee involvement. Employees are sensitive to the needs of their agency and can suggest improvements at no additional cost (beyond salary) to the State. Also, employees can become as familiar with the new system as they were with the legacy systems right from the start (Perlman, 1999). Montana took the poor man's approach using 32 State employees from 10 agencies to assist with the implementation project.

Whether a rich man's or poor man's approach is used, governments agencies are budgeted with limited resources to do the entire job. Often, the agencies will use a combination-type approach. For example, an agency might involve systems integrators to manage the implementation and internal technical staffs to maintain the systems.

3. Great Britain's Defense Evaluation and Research Agency

Great Britain's Defense Evaluation and Research Agency (DERA) is an agency of the Ministry of Defense (MOD) responsible for research, technology and test evaluation on military equipment. DERA is one of Europe's largest research organizations employing 12,000 people. Their services include operational studies and analysis as well as basic and applied research for the military. DERA also provides test and evaluation of military hardware in both the development stage and during actual operations. (M2 Presswire, 1999)

DERA invested £18 million in an ERP system to manage their human resources, financial management and project management. The process, which also emphasized the electronic supply chain, went live in December 1998. With a need for better information and a management view of their purchasing patterns and dealings with suppliers, ERP provided the leverage of purchasing power with suppliers.

Because DERA applications are Web-enabled, the ERP solution offered a capability for Web-interface, which offered the right degree of functionality in each department. Implemented as a single-system, single-view and single-source structure, the ERP system offered a higher degree of flexibility over the replaced hybrid legacy-based systems. As the Finance Director for DERA remarked, "the hardest thing may be to convince our users that they no longer need to know how to input and manipulate the data as in the past", ERP will do it for them (M2 Presswire, 1999).

4. Summary of Government ERP Projects

Private sector companies have been installing ERP systems for almost a decade. Government agencies, in the past few years have joined their private counterparts. In 1998, 3.7 percent of the ERP industry revenues were tied to government's accounts (Perlman, 1999). While Y2K concerns were a factor for ERP implementation, the primary reason is the government Information Systems (IS) were surpassing their useful life (Perlman, 1999). IS programs were developed in the 1970s and as they were modified over the years, they became hybrid legacy systems that were becoming cumbersome and unmanageable. The theme from the three cases was the need for a state-of-the-art decision support system to allow each organization the capability to assess common data and enhance their understanding of revolving trends to ease the bureaucratic process.

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III. LITERATURE REVIEW

A. INTRODUCTION

The literature on ERP provides an in-depth look at the evolutionary development of information technology (IT) relative to the desires of business to gain a competitive advantage in an environment dependent on computers and associated technology. Early applications of computers were often implemented without a structured development methodology. The emphasis was on programming, rather than on design, which meant the technical aspects of development were considered with little or no user needs involved. Consequently, information systems design was sometimes inappropriate for an application in a business setting.

In the mid 1960s, computer system designs evolved to eventually accommodate a business application. Material requirements planning (MRP) was introduced and during the decades that followed manufacturing resource planning (MRP II) and enterprise resource planning (ERP) evolved. The computer was now being utilized for complex and yet routine tasks that enabled organizations to benefit in terms of establishing a meaningful planning system. Specific literature sources are discussed below with Table 3.1 summarizing the ideas presented in the literature reviewed.

Authors	Salient Points
Keller – Gartner Group (1991)	• Gartner Group credited with introducing the term Enterprise Resource planning (ERP) • ERP is an evolutionary process from MRPII • Considered ERP strategic not tactical
Hicks and Stecke (1995)	• ERP decisions will affect the supply chain • Software development was crucial for vendors in early stages of ERP
Little and Yusaf (1997)	• Believes MRPII to be efficient and complete • Surveyed 120 firms on their understanding of ERP compared to MRPII • ERP a natural evolutionary stage as manufacturing becomes more complex
Parker (1996)	• ERP a phenomenal success in mid-1990's • Vendors focused on specific programming for specific industry segments
Ross (1999)	• ERP enables business processes to fit the system rather than the other way around • Five stages of ERP implementation; Design, Implementation, Stabilization, Continuous Improvement and transformation • Strict discipline required to implement ERP
Reyelts (1999)	• One of the first to research the ERP process in the Navy • Compared best practices of private sector and government agencies that have implemented ERP • Summarized five categories of ERP best practices: 1) people related issues, 2) process innovation, 3) use of emerging industry technology, 4) business case analysis for comparison and 5) risk management
Berg and Flauntleroy (1999)	• Discussed the Navy's strategic planning for ERP • Pilot programs currently being developed in selected navy commands • Commercial – off – the shelf systems are desired for ERP implementation • Four ERP solutions currently under consideration by the Navy
Bergey, Northrop, and Smith (1997)	• System evolution is stymied by legacy systems • Seven elements required for a successful re-engineering: 1) Organization, 2) Project plan, 3) Legacy systems, 4) Systems engineering, 5) Software engineering, 6) Technologies and 7) Target core systems • Introducing new systems, such as ERP, should not adversely affect current operations
Galliers and Swan (1999)	• Business Process re-engineering (BPR) is a critical factor in gaining a strategic advantage in IT • BPR a technically efficient management fad • Strategic change relies on 1) discovery, 2) redesign and 3) realization

Table 3.1 Defining Bullets by Author for Literature Review

B. EARLY ERP

Gartner Group coined the term Enterprise Resource Planning or ERP (Hicks and Stecke, 1995). As early as 1991, Publications of the Gartner Group discussed the transitioning of business systems from MRP II to ERP by manufacturers (Hicks and Stecke, 1995). ERP evolved from Management Information Systems (MIS) through generational changes that included Materials Requirement Planning (MRP) and Manufacturing Resource Planning (MRP II).

MRP developed in the mid 1960s, allowed businesses to develop programs to plan and manage inventory. MRP is based on a schedule of what is going to be produced and the list of material that is needed for a finished item. An information system (IS) then calculated the materials requirement and compared it to what was in inventory or scheduled to arrive. George Plossl, sums it up by saying, "MRP calculates what I need, compares it to what I have, and calculates what I need to go get and when." (Ptak and Schragenheim, 2000)

As technology improved so did the realization that as inventory moves along the manufacturing process, there are associated financial aspects that should be considered. Under MRP II, as the manufacturing process occurred, inventory and final products were now carried in accounts that kept track of all costs from start to finish. The available technology was now able to track the inventory and financial activity, thereby closing the loop, not only with the financial accounting system, but also with the financial management system too (Ptak and Schragenheim, 2000).

The Gartner Group stated the jump from MRP II to ERP would represent a revolution rather than an evolution in business affairs. They reasoned that many new technologies and

architectures were simultaneously entering into a marketplace that had remained unchanged for the last 20 years (Keller, 1991). In the 1980s, the cost of technology was plummeting as the personal computer became commonplace in the office (Ptak and Schragenheim, 2000). Large mainframes were being replaced by client-server technology whose power often exceeded those of the mainframe. It was now possible to run a fully integrated MRPII system on a small computer (Ptak and Schragenheim, 2000). These transitions in computer technology are usually incremental and require a strategy and plan to be effective. One strategy pertains to the purchasing of software by a user. They first must determine if their installation was either tactical or strategic in nature. If the software was tactical (i.e., solving a near-term problem), then the most functional and stable software package should be selected. If the implementation of a business system was strategic (i.e., systems will be integral to a company for at least a decade), then the software should offer a degree of inherent flexibility for future expansion and growth.

The Gartner Group (Keller, 1991) discussed the need for an ERP system to have the functionality of the MRP II systems, but address the needs of complex manufacturing systems from a strategic perspective. In addition, they felt the incorporations of graphics and external integration via electronic data interchange were key requirements in the migration to ERP (Keller, 1991). Lacking in MRP II, these requirements combined into a software model would greatly benefit users by reducing the cost of hardware and operating complexity, easing configuration requirements, simplifying customization, reducing initial and lifecycle costs and providing a single view of enterprise data.

Hicks and Stecke (1995) defined ERP as a process concerned with making sure a firm's manufacturing decisions are not made without taking into account their impact on the supply chain and production process which includes the major areas of engineering, accounting, and marketing. By having the ERP process take into account these important interactions within a business, better decisions would be made across organizational boundaries.

Hicks and Stecke (1995) further discuss the impact client/server technology is having on the then infant ERP industry. They discuss the advantages of taking a modular approach to ERP. Software programs can be kept small enough to run on personal computers. Since many important production and inventory decisions are made in different places and at different levels throughout an organization, ERP and its modules of software functions is a good fit for distributed computing.

Another issue Hicks and Steele discuss is whether the ERP market is homogeneous or heterogeneous. While every company's problems are different, many problems are variations of common themes. Are the similarities strong enough to support a "mass market" approach to software? Or are the differences going to keep the manufacturing software market a wide-open arena of niche specialists, systems integrators and solutions consultants? Hicks and Steele state that the issue may be moot, because it will likely be decided by a company's financial situation. (Hicks and Steele, 1995)

Little and Yusuf (1997) reviewed the developments in manufacturing control systems over the last twenty years by discussing the role of Manufacturing Resource Planning

(MRPII) in the manufacturing industry. They examine the areas covered by MRP II developments and the concept of ERP replacing MRP II as a business practice.

Little and Yusuf (1997) assert MRP II was an excellent high-level planning system for material control. Early MRP II systems were described as a "push" system or one that tends to push work onto the shop floor with a set due date of completion regardless of whether there was sufficient capacity to deal with it. It was effectively considered an open-looped system. As different manufacturing modules were introduced, the loop was closed to provide an effective closed-loop MRP II system.

As MRP II developed, the basic facilities of this closed-looped system were expanded to support non-manufacturing functions such as sales, costing and purchasing. Sales order processing systems were developed to support demand forecasting, while scheduling modules were developed to provide engineering modifications and control systems. MRP II had developed into a business information system, not just a manufacturing control system. (Little and Yusuf, 1997)

Little and Yusuf (1997) argue the ERP system was a natural evolution of MRP II and with additional functionality was able to develop as a better plan for the ordering and delivery of products. They view ERP as a development process towards a fully integrated system in manufacturing plants. This view was not without reservation. They state the current efforts to produce larger and more extensive ERP packages might be self-defeating. Little and Yusuf (1997) argue that these packages were time consuming to implement, weak in support of shop floor performance, and have little impact upon product development. They state that MRP II was the most efficient and satisfied all the requirements for effective manufacturing.

To prove their point, Little and Yusef conducted a survey. Of the firms surveyed there were 120 respondents. They were asked to give their views of the importance of extending their MRP II systems with the introduction of 11 additional business modules. All respondents showed a marked interest of integrating their current MRP II systems with at least two of the 11 additional modules. Nevertheless, not one of the 120 respondents claimed to be using an ERP system, even though their organizations were migrating towards that architecture. They were aware of ERP and felt it was another step along the road towards fully integrated systems, but reserved its implementation for the future. (Little and Yusuf, 1997)

Little and Yusuf seem reluctant in conceding that ERP can replace MRP II. They state, "current efforts to produce ever larger and more wide ranging 'ERP' packages may well be self-defeating. They are time consuming, appear to be weak in support of shop floor performance and have little impact upon product development." (Yusak and Little, 1995)

Early literature on ERP focused on defining it in terms of software development and implementation into the core of corporate IT. Noticeably lacking was the relationship ERP had on corporate culture (in the broadest sense).

C. ERP - CURRENT GENERATION

Since its introduction in the early nineties, ERP has become a success in the information technology (IT) arena. In discussing ERP, Parker (1996) focused on the growth in demand for ERP systems within the software industry. Revenues for ERP vendors in 1995 were $3.5 billion. In comparison, 27 ERP suppliers in the top 50 took in nearly $5 billion in 1996 (Parker, 1996). The assessments of market research analyses indicated the ERP growth curve would continue. Advance Manufacturing Research of Boston expected ERP total

license and maintenance revenues to exceed $5.5 billion in 1996, up from nearly $4 billion in 1995 (Parker, 1996). Gartner Group predicts the revenues from primary ERP vendors will grow by at least 20 percent on an annual basis (Parker, 1996). Although there are differences in the amount of growth, one thing is clear: ERP software companies are experiencing growth in the 20 to 40 percent range a year. However, these figures do not include the growth in the total market, which includes third-party suppliers of hardware and consulting services. In 1999, ERP vendors and related businesses billed their customers an estimated $20 billion and it is projected that by 2003, these revenues will triple to over $66.6 billion (Knorr, 1999).

Parker (1996) discusses the operating systems that will be the platform for ERP. Parker contends ERP is responsible for traditional procedural programming code being replaced with object-oriented programming code. The results are a requirement for less code, which allows manufacturing systems to provide better models and greater detail in actual business operations (Parker, 1996). ERP developers, through experience, have learned what manufacturers want concerning computerized systems. As a result, vendors are differentiating themselves from their competitors by adjusting their systems with functionality for specific industry segments. These industries include the process industries (chemicals), automotive (including suppliers), consumer-packaged goods, and highly engineered goods industries. Three operating systems: Unix, ASA/400 and Windows NT had emerged as the dominant choice because of their industry-specific functionality. (Parker, 1999)

Parker (1996) briefly discusses 34 software companies specializing in ERP. He summarizes their goals and strategies and discusses their approach as ERP vendors. From the leaders -- SAP, Baan and Oracle -- to smaller firms such as Pivotpoint and PowerCerv, each

ERP vendor provides ERP solutions that are tailored to a company's requirements. Each vendor's purpose is to move product from the point of origin to consumption in the least amount of time and at the smallest cost. They have also concentrated on incorporating industry-specific functionality into their product to attract major manufacturers as well as mid-range manufacturers.

Basically, ERP vendors are supply-chain vendors. A distinction is made between transactional systems and decision-support systems for areas of demand and distribution management or production planning and scheduling. The two types of systems need each other. ERP has the data, and decision support has the applications based on in-memory processing. Increasingly, alliances are easing integration between platforms. Parker addresses how the market would play out in this area in 1996, by discussing the tactical issues the vendors addressed that year. These included increasing incorporation of industry-specific functionality, a reaffirmed commitment to the mid-range manufacturer, and the acknowledgement that Windows NT would have an increasing role in ERP. (Parker, 1996)

As ERP use increased, ERP was being discussed in terms of a process improvement as well as a management tool. In order to realize an improvement in any process, an organization must prepare for a series of transformational steps (Ross, 1999). Ross (1999) states that business' performance will get worse before it gets better when ERP is implemented. She argues that resistance to change will be significant and reflected in a downward trend in production. Ross also mentions an organization is more likely to reap benefits if the business processes are molded to fit the ERP system rather than the other way

around. In her studies of 15 companies, Ross found this to be the case when she surveyed the managers of the firms.

System integration has become a critical issue with mergers and acquisitions leaving many companies with incompatible IT systems (Ross, 1999). Such incompatibility makes competing in a global environment almost impossible. Ross (1999) cites an example of one company using 23 different accounting systems while another had 14 bills of material. This incompatibility made competing in a global environment almost impossible (Ross, 1999). Ross writes most companies expect ERP to reduce their operating costs. They also expect it to produce improvements in areas such as logistics, production scheduling, and customer service. Yet, other companies were concerned about customer responsiveness. They want to standardize processes to ensure quality and predictability in their global business interests by reducing cycle times from order to delivery. They felt this method is a key ingredient to customer satisfaction.

Ross discusses the path of ERP implementation as a process. The measurement of ERP will show a marked decline in performance by a firm before it gets better. Five stages of ERP implementation are involved in this process and they are (Ross, 1999):

1. Design - All ERP packages provide choices on configuration of software, but assumptions must be made about the data flow through the system. At this stage, a decision is required on whether to accept these assumptions or not. This is different from traditional systems development where a decision on processes is made and then the systems are built to support them. Process standardization can be considered a key design decision. Management must decide whether to

standardize across geographic or product lines and business units. The extent of standardization must be determined before the implementation process begins. Ross sums it up by comparing ERP to concrete – "easy to mold while it's being poured but nearly impossible to reshape after it has set" (Ross, 1999).

2. Implementation – Even with careful planning and training, going live usually is highly disruptive. Implementing ERP is a commitment to a new way of doing business. Employees will need training to understand how ERP will change the business processes. Management will need information that shows the ERP's effect on business performance and with implementation, this information is not automatic. Management must design reports or processes for accessing the required data. The post-implementation stage is important too because the redesigned processes might be viewed as hurting the business in the short run. But it can provide the opportunity to redesign and re-engineer processes to make them more functional.
3. Stabilization - With ERP implementation, a dip in performance should be expected and could last for four to 12 months. During this phase, many firms found themselves suffering from bad data being generated despite efforts to ensure it was clean. In addition, unexpected system failures, and most importantly, difficult adjustment to new processes were limiting the use of the system. To the benefit of an organization, this time could be well spent in providing an opportunity for training, particularly in the area of new processes, and to work with the vendors and consultants to work out any bugs in the process and software.

4. Continuous Improvement - During this stage, increasing functionality occurs with the addition of new models. Other improvements like electronic data interchange (EDI), bar coding, sales automation, and sales forecasting can be added. During this phase, process redesign and implementing new structures can also occur. The important thing to remember is the value derived from ERP is the direct result of ongoing efforts to instill discipline in the organization and to continuously improve processes.
5. Transformation - This stage is defined as one where ERP offers the organization to become more customer and process oriented by changing their organizational boundaries. Companies that transform to this stage demonstrate their commitment to ERP by:
    - Assigning their best people to the project 100 percent of the time.
    - Developing a clear business case, which clarifies performance objectives.
    - Demanding regular reports based on established metrics.
    - Communicating goals and establishing program scope.
    - Establishing a long-term vision.

Ross (1999) discusses the resistance encountered during implementation. It is hard for people to change especially in areas they are familiar with and effective. But with ERP, these people, especially those in middle management, have to do some "unlearning." In summary, Ross (1999) discusses the difficulty in implementing an ERP system is not with it being a new system, but because it means there will be changes made. The challenge of ERP requires strict discipline in organizations that are usually undisciplined. While it helps the

organization respond to changes in market demands and customer needs, employees usually do not see this cultural change as an improvement and therefore tend to remain skeptical.

D. ERP IN THE DEPARTMENT OF THE NAVY

As the Navy undergoes a re-engineering process on how it performs many of it functions, the Navy's program, Revolution in Business Affairs (RBA), has called upon the leadership in the Navy to develop systemic methods to translate the best practices in business to the Department of the Navy (DoN) activities. (DoN, 1999).

Reyelts (1999) was one of the first to focus on ERP in the Navy. He examined how ERP solutions can be effectively implemented within the Navy, using best practices and lessons learned from businesses and governmental organizations.

Reyelts (1999) discusses how ERP providers such as SAP, BAAN, or Oracle develop enterprise-wide information systems that integrate functional business processes into seamless IT solutions able to be readily implemented by an organization. These providers offer a generic solution that contain common business practices and best practices for an organization. A gap analysis is then done to determine the peculiarities of an organization's business practices; any unique requirements discovered can be added by either a code modification or bolt-on applications from third party vendors. Typical enterprise solutions consist of software modules, which may include the following functional areas: company financials, business technology, project management, performance management, procurement, and the supply chain module. This enables the ERP provider to build an enterprise-wide solution based on an organization's requirements, typically resulting from process re-engineering or process redesign. Reyelts (1999) discusses the key objective of ERP solutions

is to initiate and sustain process change and not merely implementation of a software package. He further defines ERP as a lever for change that is an enabler of process innovation and as an enabler, ERP will allow an organization, such as the Navy, to benefit by integrating business processes which optimize functions across the enterprise.

Reyelts (1999) writes that the Department of Defense is well suited to implement ERP solutions at the enterprise (i.e., uniform service) level. He further states the Navy would benefit from implementing ERP by providing utility for the aging legacy systems while developing new applications. Using ERP solutions for legacy systems conversion will benefit the military by capitalizing on commercial best practices such as Enterprise Application Integration (EAI). EAI will allow the Navy to merge separate legacy mainframe applications and databases with ERP solutions to capitalize on new technology while using existing data (Reyelts, 1999). Comparing ERP best practices in both the private sector and other government agencies, Reyelts was able to summarize five categories of ERP best practices. The categories in order of importance are: 1) people related issues, 2) process innovation and support, 3) use of emerging industry technology, 4) business case analysis for comparison, and 5) risk management. Determining best practices from these categories is essential to successful ERP implementation. (Reyelts, 1999)

In December 1997, Secretary of the Navy Dalton tasked Under Secretary of the Navy Hultin to begin work on a DoN strategic business plan to address the need for reform in the business affairs of the Navy. Berg and Fauntleroy (1999) write that the initial strategic planning effort began with three working groups. The groups met in June 1999 and focused

on personnel issues (recruiting, training, and assignments), housing reforms, and commercial financial practices.

The Commercial Financial Practices (CFP) Working Group led by VADM Lockard decided the Navy should change the CFP concept to include commercial best practices. Consequently, the working group was changed to the Commercial Business Practices (CBP). They decided the Navy should use ERP as a foundation for change. The working group met again in November 1998, to define a vision and set of goals. What is significant, according Berg and Fauntleroy (1999), about this meeting was that the group determined the critical success factors and challenges the Navy will need to consider in defining their visions and goals regarding ERP. For example, the success factors included leadership/DoN buy in, process ownership, and a realistic implementation plan. The challenges were numerous and included poor incentives, lack of cost and performance data, budgeting as the only management tool, and lack of IT standardization. In addition, two major hurdles, cultural and financial in nature, existed and were by far the major obstacles to successful ERP implementation (Berg and Fauntleroy, 1999).

When looking at the Department of the Navy, the definition of an enterprise may take on many meanings. Berg and Fauntleroy (1999) explain each organization within the Department is a separate entity creating its own budgets and manages its own funds and resources. Therefore, systems or operational commands could be considered enterprises. In effect, the Navy is a series of nested enterprises from and among which information flows. In Figure 3.1, the arrows denote the flow of information among the commands or enterprises.

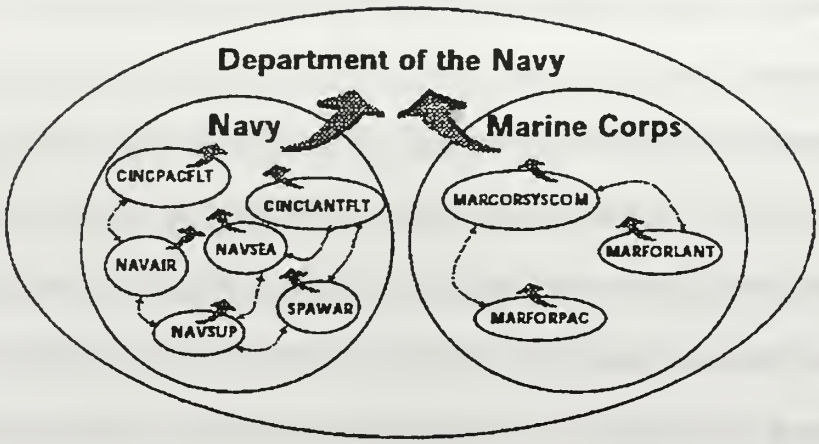

Figure 3.1 Department of the Navy Enterprises
(Berg and Fauntleroy, 1999)

The Navy has decided to initiate pilot programs within each command to demonstrate the ability of existing ERP solutions to provide business solutions, as well as to provide a backbone capability when integrating the programs (Berg and Fauntleroy, 1999).

Teams responsible for developing ERP with the DoN identified three issues that required higher-level attention:

- Development of an integration backbone.
- Developing common data definitions.
- Selecting an ERP solution that can integrate easily with the other pilots.

Berg and Fauntleroy (1999) discuss each issues and what aspect they play in implementing ERP. The integration backbone issue concerns the Navy's determination of using Commercial off the Shelf (COTS) systems combined with their legacy systems. It is safe to assume no single COTS package can handle all the functions required by the DoN. In addition, the problem of interfacing with mandated IT systems such as Defense Financial Management

System (DIFMS) will put an additional burden on implementing ERP in an organization as large and diverse as the Navy (Berg and Fauntleroy, 1999). There will be trade-offs to be considered between implementation and maintenance factors as the pilot programs select their ERP solution.

The issue of defining common data structures must be addressed as ERP is integrated Navy-wide. Much of the information collected will stay within the organization, while other data may move in a number of smaller arenas outside the organization. This being the case, each pilot program needs to look at the data it has defined in its ERP solution and then work with other related users to define common data structures. In essence, the final product will have multiple common layers of data that will be used to create a common data dictionary. In choosing an ERP solution, the pilot program managers are currently evaluating the options and developing a strategy for implementation. Their options include 1) a single ERP solution across the pilots, 2) a single ERP solution across functions, 3) a single ERP for each pilot and 4) multiple ERP solutions within each pilot. Selection of an ERP solution for the pilot programs is currently underway with two projects under contract. (Berg and Fauntleroy, 1999)

E. ISSUES ON IMPLEMENTING ERP

Bergey, Northrop, and Smith (1997) discussed the issues many organizations are facing when they plan to "migrate" from their legacy systems to distributed open system environments. Organizations everywhere are experiencing tremendous pressure to evolve their systems to better respond to marketplace needs and rapidly changing technologies. According to Bergey, Northrop, and Smith (1997) this constant pressure to evolve is driven

by escalating customer expectations and the need to respond to new enterprise standards. Organizations are also concerned about the ability to incorporate new products and system features, improve performance, cope with endless new software releases, and stave off hardware and software obsolescence.

In discussing the re-engineering effort required for a successful system evolution, Bergey, Northrop, and Smith (1997) presents an enterprise framework structure consisting of seven elements. Each element has a critical set of technical and management issues essential for developing a comprehensive plan of action.

1. Organization - Plays a key role because the real barriers to success are related to management and culture:
    - Are the goals of the organization aligned with the enterprise goals?
    - Are the roles and responsibilities of each of the organizational units involved in the system evolution effort well defined?
2. Project - A structural unit within an organization, which is responsible for evolving a system, that provides products and services to the organization and its customer:
    - Is there a comprehensive project plan?
    - Is ownership of each plan and project work product established clearly?
    - Is there a clear understanding of the organization's goals and a linkage between the organization's strategy and the project's strategy?
3. Legacy systems - An operational "software-intensive" system that is a candidate for evolutionary improvement:

- How extensive is the system documented? Is the documentation current?
- Is there a current system configuration diagram and system design document?
- How stable is the system's operation? Have the unresolved problem reports and change request been reviewed for trend information?

4. Systems engineering - A set of elements required for system analysis, design, validation, and operation:
    - Has an incremental development strategy been adopted?
    - Are appropriate systems and software engineering tools being used?
5. Software engineering - Elements within a core discipline revolving around architecture design, testing, and validation:
    - What evidence is there to support the effectiveness of software engineering?
    - Are programming guidelines established and followed?
    - Is there a strategy in place for achieving upward software compatibility?
6. Technologies - Evolutionary changes are frequently driven by promising new technologies meeting business processing needs, overcome technical obsolescence, and counter increased maintenance costs:
    - Is the technology a prerequisite for the system evolution effort?
    - Have the benefits of adopting the candidate technology been qualified?
    - What is the potential impact of not adopting the technology?

7. Target systems - Consists of the target core system, the target operational environment and target support environments. Since the legacy and target systems represent a "before" and "after" picture of the re-engineered system, the elements of the target system closely mirror those of the legacy system:
    - Is there a concept of operations to describe the proposed target system?
    - Are there standards and ground rules for the target system?
    - What is the projected impact of the proposed changes on performance and availability?
    - Have training needs been identified for customers and users of the system?

Bergey, Northrop, and Smith (1997) discuss an expanded view that includes a characterization of the legacy and target system elements and a representative set of activities, key processes, and work products, which characterize an enterprise-wide approach. Their framework elements are presented to depict the intricacies and complexities occurring in evolving software-intensive systems. They go a step further to illustrate the need for a disciplined approach to system evolution to ensure the many diverse activities, processes, and work products are suitably coordinated and integrated into a cohesive plan of action.

Bergey, Northrop, and Smith (1997) take the concepts of their framework elements and discuss the approach necessary to implementing an enterprise re-engineering plan. Two major parts to the approach are: the baseline phase and the evolution phase. The baseline phase focuses on the organization, project, and legacy system. While the evolution phase focuses on the target system, systems and software engineering, and technologies used to

produce the target system. In simpler terms, the first phase focuses on the problem space, and the second phase focuses on the solution space (Bergey, Northrop, and Smith, 1997).

In their concluding remarks, Bergey, Northrop, and Smith (1997) discuss the major challenges of re-engineering is to ensure the introduction of new capabilities does not adversely affect the current systems in operation. This may impose significant constraints on the approach to re-engineering a system (Bergey, Northrop, and Smith, 1997). Their enterprise framework can meet these challenges by identifying the contributing factors to consider in software evolution.

Galliers and Swan (1999) discuss Business Process Re-engineering (BPR) as a critical factor in gaining a strategic advantage with information technology (IT). They define BPR as a planned, rational approach and phased approach to the management of organizational change. BPR uses IT and other tools, such as ERP to enable analysis, redesign, and improvement of operational effectiveness along the entire organizational chain with particular emphasis on customer satisfaction, competitive advantage, and cost reduction. Encompassing this change is:

- Discovery - Where key processes are identified and potential and scope of re-engineering is identified.
- Redesign - The core processes to be changed are examined in greater detail and change management goals, issues, and potential problems are identified.
- Realization - The change program is implemented and the organization is transformed with identified improvement goals.

Galliers and Swan (1999) are skeptical about BPR. They state it is technically inefficient, but allows for organizational change that can make sense of complex and uncertain problems. In further analysis of BPR, the tendency towards describing it in terms of a single, profit-maximization objective, the term "re-engineering" determines first what a company must do, then how to do it. In concluding their thoughts on BPR, Galliers and Swan feel their analysis provides a message that the very process of implementation should be considered key in business process re-engineering.

Innovation does not stop at adoption of BPR processes, but needs to be considered along with implementation. Galliers and Swan (1999) note innovation is context specific and socially shaped. Ideas behind "best practices" are called into question: while suppliers are interested in adoption of best practices, users are more interested in their implementation. They note too, with best practices, it is the process of managing the strategic change that requires attention. Political processes within the change process are becoming a key point in research concerning implementation.

Resistance to information systems (IS) implementation comes about because of the realignment of status, power, working habits, or any change in a group's shared values and meanings. Galliers and Swan discuss factors, which contribute to the failure of an implementation effort. These included uncertainty over jobs and skills, lack of a need for IS, redistribution of power and resources, lack of organizational validity, and lack of senior executive support. These factors need to be considered when designing and implementing IS because ultimately the different political cultures involved often require different information and may process it differently. In their concluding remarks, Galliers and Swan acknowledge

"fads" have their place. They use BPR as a case in point for them to review of the role of IS in critical organizational change. Finally they conclude with "IS and strategic change is no more IT-enabled process innovation than it is IT-enabled competitive advantage." (Galliers and Swan, 1999) The paradox in an attempt to be forward thinking and innovative, BPR might be seen as being unable to deliver promised solutions, because key lessons have not been retained and applied (Galliers and Swan, 1999).

F. SUMMARY

As the introduction to this chapter stated, the literature review provided a look at ERP, from evolution to implementation. Key historical factors were discussed, along with common themes associated with implementing ERP. One theme, apparent in the readings, was the ERP process, which was comprised of two elements: software-based applications and management response. NAVAIR is currently implementing ERP in four waves with full ERP capability by FY 2005 (ERP Overview Briefing, 2000). This will include NAWCAD, and it is important for them to understand the implications that ERP will cause during this transition.

The importance in understanding the complexities of implementing ERP emerged from the literature review. The difficulty in implementing ERP was not in the introduction of a new IT system, nor was it the simple notion of change. Instead, the challenge related to instilling discipline into an undisciplined organization. The term "cultural change" was often mentioned when discussions were related to how management perceived what roadblocks were impeding ERP. An ERP environment emphasizes constant change and reassessment of organizational processes that are standardized but not static. Legacy systems are the opposite in that they

inhibit change required to respond to marketplace needs and rapidly changing technology (Bergey, Northrop, and Smith, 1997, Ross, 1999).

Reviewing the material on ERP in the DoN, necessity echoed as a common theme for the reason ERP should be implemented. As the Navy enters into the 21st Century the improved management of the infrastructure, particularly from the business perspective needs to be accomplished. IT can enable an organization as complex as the Navy to provide services in ways not previously possible. The private sector has improved their global competitiveness by re-engineering their business processes and management structures. The Navy is approaching their current business processes from an enterprise-wide perspective by adopting a customer-oriented focus (Reyelts, 1999, Berg and Fauntleroy, 1999).

The next chapter examines the current business practices conducted at NAWCAD and discusses how they are related to its organizational structure.

IV. NAWCAD COMPETENCY ALIGNED ORGANIZATION PROCESSES

A. INTRODUCTION

This chapter discusses NAWCAD and its current business processes used in its integrated program team approach. A synopsis of each department is presented with emphasis on the Operations Competency and their contribution to NAWCAD's financial management systems.

B. HISTORY OF NAWCAD

In reaction to the 1991 Base Realignment and Closure (BRAC) Commission's decision to streamline the Naval Air Systems Command (NAVAIR), the Department of the Navy began to consolidate its technical capabilities to improve its products and services. NAWCAD stood up January 1, 1992, at NAS Patuxent River, Maryland taking on the role as the Navy's research, development, test and evaluation (RDT&E), engineering and fleet support center for military aircraft. NAWCAD was created with the realignment of five field activities. Today, two sites exist due to further BRAC rounds that consolidated NAWCAD. These sites are located at Patuxent River, Maryland and Lakehurst, New Jersey (NAWCAD Corporate Overview, 2000).

C. BUSINESS BACKGROUND

In 1994, NAWCAD adopted a new business management structure because of the corporate downsizing brought about by two BRAC rounds. Early in 1993, VADM Bowes established a Concept of Operations Study to focus on how NAWCAD should conduct business in the years ahead. An organizational structure was required to allow NAWCAD to

provide support and products to their Fleet customers while downsizing and reducing costs. Investigations determined that organizations such as Hughes, McDonnell Douglas and Boeing had successfully implemented Competency Aligned Organization structures into their business practices. These investigations found that this structure was not only effective, but also efficient in similar downsizing and budgetary drawn downs. (NAWCAD Compendium, 1999)

In October 1994, NAWCAD was managed by a Competency Aligned Organization/Integrated Program Team (CAO/IPT) or CAO. By operating under this new structure NAWCAD was able to meet customers needs, integrate its sites into a cohesive organization, become team oriented, develop and empower their employees and remain flexible in a changing environment. This reorganization was necessary for NAWCAD to remain capable of providing the full spectrum naval aviation support to its customers while downsizing. CAO also improved competitiveness, project execution, and quality and efficiency while incorporating continuous improvement throughout the organization. All capabilities and resources were categorized into seven core competencies: Program Management, Contracts, Logistics, Research and Engineering, Test and Evaluation, Industrial, Corporate Operations and Shore Station Management. (NAWCAD Compendium, 1999) Figure 4.1 shows the relationship between competencies, teams and customers.

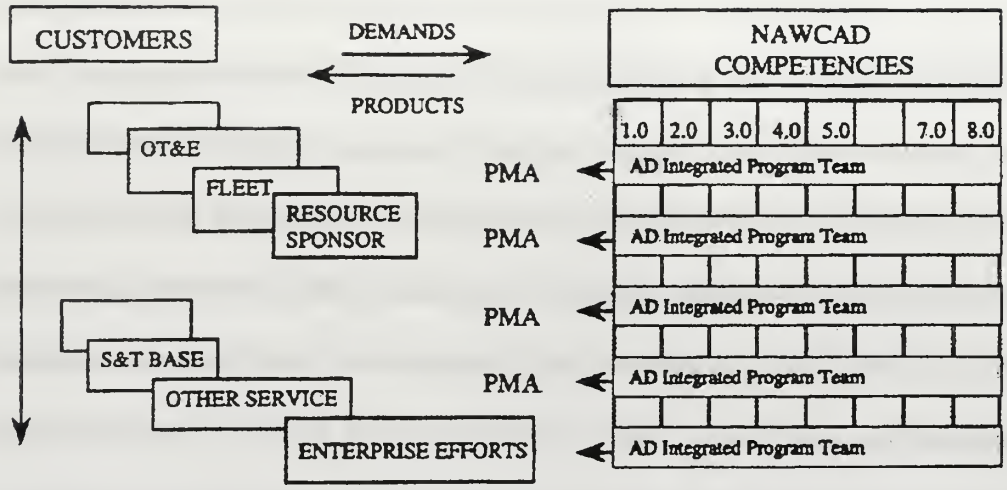

Figure 4.1 NAWCAD Competencies, Teams and Customers Relationship
(NAWCAD Compendium, 1999)

D. OVERVIEW OF CAO STRUCTURE

The CAO is structured so employees and functions are aligned to one of seven competencies. Figure 4.2 illustrates the NAWCAD alignment.

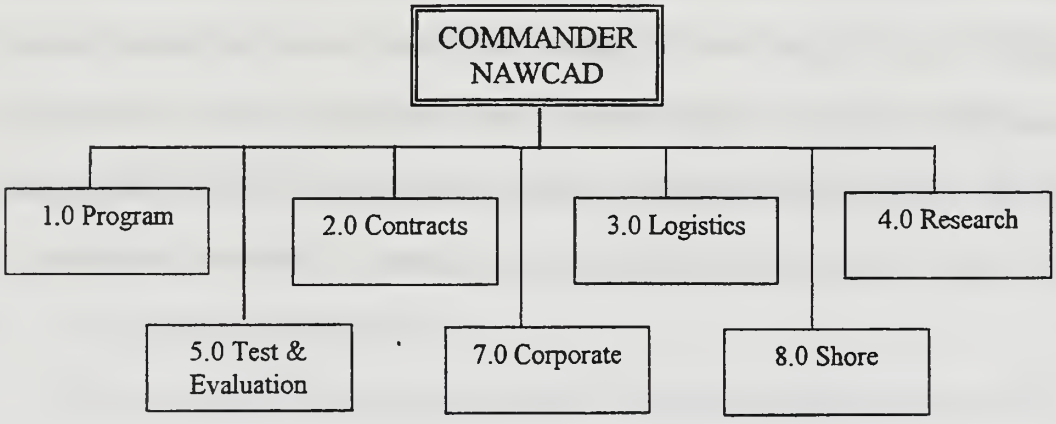

Figure 4.2 CAO Alignment Structure
(NAWCAD Compendium, 1999)

Within a competency, managers provide supervisory functions, such as training recommendations, skills certification and the establishment and communication of common methods and business processes. The competencies provide qualified personnel, facilities and equipment to the program teams, where the work is performed. Once selected for a program, the individual will be assigned to work on that program's team. Work will then be performed under the leadership of a team leader. Team members will return to their competencies for training or new tasking due to completion of their project. (NAWCAD Compendium, 1999)

Teams produce and/or support the production of the products and services, which are delivered to the customer. A team leader will determine what product is needed and the funding, resources and tasks to get the product developed. The team leader will then go to the competency managers to explain the requirements to receive the resources. (NAWCAD Compendium, 1999)

E. TEAM DEFINITION

A Naval Aviation System's TEAM is defined as a group of individuals from across multiple competencies assigned to work on all programs, led by a designated Program Manager, and is referred to as a Program Team. This team may be comprised of a number of sub-elements known as Integrated Program Teams (IPTs). In turn an IPT for a major product may be composed of multiple IPTs, each associated with key sub-products and services in accordance with Program Manager cost, schedule and performance guidelines. IPTS are self-managed and empowered in accordance with Program Manager delegated authority and program risk. (NAWCAD Compendium, 1999)

There are other teams involved within the TEAM concept that are also lead by team leaders who have similar cost, schedule and performance responsibilities. The Externally Directed Team (EDT) provides product and services to non-NAVAIR customers. Other teams such as the Product Support Team (PST) and Enterprise Team (ET) provide for the general needs of NAWCAD and fall into three categories:

1. Corporate Support – responsible for providing administrative and support functions that are common across NAWCAD.
2. Competency Support – perform functions that support, develop and maintain intra-competency operations.
3. Technical Support – provide products and services that support multiple IPTs and EDTs.

Team size has no bearing on responsibility for the product produced or services provided. Program requirements define team composition. Depending on the specific task, however, an effort could be confined to a single competency or limited to a single individual. (NAWCAD Compendium, 1999)

F. COMPETENCY STRUCTURE DEFINITIONS

Each competency at NAWCAD is an organizational element that contains people with knowledge, skills and experience in particular disciplines. The technical facilities, equipment and processes necessary to satisfy program demands are included in each of the seven competencies:

Competency 1.0 - Program Management – Formulates and maintains policy for standard IPT implementation and EDT oversight. Competency 1.0 also establishes and maintains the

processes to monitor cost, scheduling and performance for each project team. Included in competency 1.0 responsibilities is the requirement to provide Program Managers with support services to develop, plan and execute projects to satisfy program customer requirements.

Competency 2.0 - Contracts – This competency involves the people, processes and facilities necessary to contract for the supplies and material needs of NAVAIR aircraft and weapon systems. Competency 2.0 is represented on each NAWCAD team providing oversight and training on implementing new contract strategies while assessing current contract analysis.

Competency 3.0 - Logistics – This competency is responsible for developing, planning and integrating support considerations into designs. The principal focus is support of the IPT and enterprise demands, along with maintaining logistic support capable of supporting fleet operations and maintenance throughout the life cycle of aviation weapons systems and related equipment.

Competency 4.0 - Research and Engineering – This competency provides processes, skills and facilities necessary for the engineering needs of science and technology development, systems acquisition and product support of aviation aircraft, weapons and support systems. Support is provided to IPTs, EDTs and ETs in the areas of Naval aviation science and technology. Included in this spectrum are: systems engineering, cost, air vehicles, propulsion and power systems, avionics, crew systems, weapons, support equipment, launch and recovery equipment, training systems, concept analysis, evaluating and planning, and test and evaluation engineering. Operating from Lakehurst, New Jersey, Competency 4.0 is the largest competency in terms of capital, employees, and funding (Briscoe, 2000).

Competency 5.0 - Test and Evaluation – This competency provides the technical knowledge, processes and facilities to support the planning, conduct, monitoring and reporting of tests for the development of air warfare systems and their support requirements.

Competency 6.0 - Industrial – No longer exists in NAWCAD. Currently, it is a NAVAIR organization only.

Competency 7.0 - Corporate Operations – Included within this competency are the employees and processes to support the Naval Aviation Systems TEAM. Corporate Operations directly and indirectly support the other competencies, IPTs, commanding officers, site managers and ETs by providing the following services: Information management, human resources, strategic management, comptroller service, legal counsel, public affairs, congressional liaison and security services.

Competency 8.0 - Shore Station Management – This competency manages the personnel, processes, skills and facilities to support NAVAIR shore activities, including on-site TEAM organizations and non-TEAM tenants. Included in these responsibilities are facilities management, environmental programs management, quality of life programs, public safety and occupational safety and health. Also aligned under this competency are the Inspector General functions, Naval aviation safety and the Judge Advocate General (JAG).

G. CORPORATE OPERATIONS GROUP (COMPETENCY 7.0)

Corporate Operations provide NAWCAD the people, processes, facilities, skills and knowledge for the operations and services support. Operating across geographical sites, Operations provides their capabilities to team projects and as enterprise work within the competencies. Figure 4.3 illustrates the organizational make-up of corporate operations.

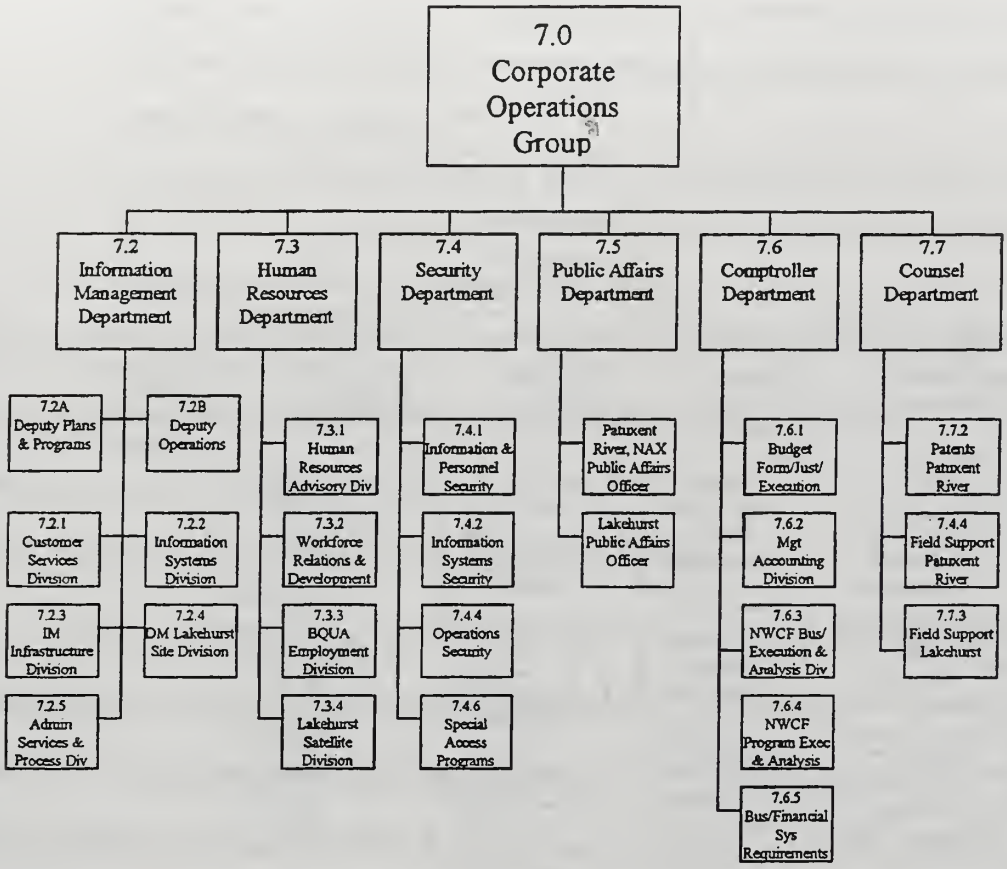

Figure 4.3 Corporate Operations Group
(NAWCAD Compendium, 1999)

Within Operations is the Comptroller Department (Competency 7.6) (Figure 4.4) whose tasking is to serve as financial advisor to Commander, NAWCAD in maintaining the integrity of financial operations and accounts as required by the Chief Financial Officers' Act. Besides being responsible for command-wide budgets through the use of managerial accounting and resource execution policies, Competency 7.6 also provides financial advice, training and services to competency organization elements, enterprises, shore station managers, IPTs and EDTs.

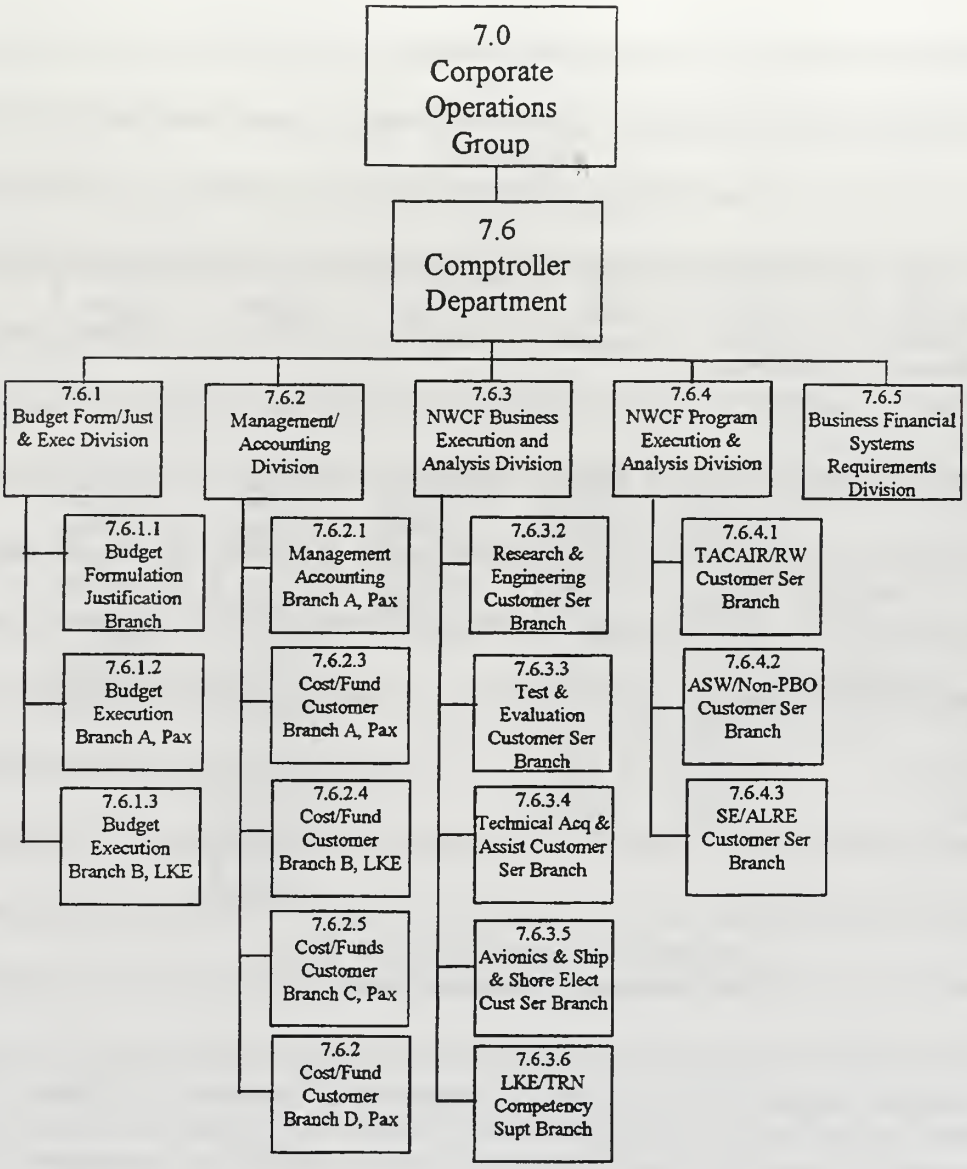

Figure 4.4 Competency 7.6 Organizational Chart
(NAWCAD Compendium, 1999)

The Comptroller's responsibilities include providing NAWCAD with the following:

- Budget execution (receipt, administration, issuance, reporting of funds; investment of funds) of Navy Working Capital Fund (NWCF), Major Range Test Facility Base (MRTFB) Fund and Expense Operating Budget (EOB).

- Financial management systems changes analysis, automated and manual business processes support, requirements definitions, systems validation and comptroller system interface integrity.
- Provides corporate level planning, analysis and management services to support the NAWCAD in planning areas that affect resource allocations of people and investments. (NAWCAD Compendium, 1999)

Other responsibilities for Competency 7.6 include tracking the Net Operating Results (NOR), developing and applying financial management performance metrics and managing NAWCAD laboratory and aircraft assets. (NAWCAD Compendium, 1999)

H. RESULTS AND ANALYSIS OF INTERVIEWS

Each Competency 7.6 Team member interviewed expressed a general feeling of satisfaction on the direction NAWCAD was heading with their financial management (FM) processes. Those interviewed stated the Competency Aligned Organization (CAO) structure was successful in making FM efficient and providing a better product to their customer. The subject of DIFMS brought about a different response. All felt it was it was a system with limited capabilities in providing the information they needed on a day-to-day basis.

1. Financial Management (Competency 7.6) In A CAO

Competency 7.6 accepted the CAO concept as a positive approach in bringing the comptroller functions such as budget formulation and execution, accounting, and business and financial analysis under a single department. One interviewee described the CAO implementation as "...a holistic organization construct whereby... analysts who support the budget formulation or execution functions were aligned alongside those functional experts. In other words, we were a 'cradle-to-grave' one stop financial shop" (Rhodes, 2000). The

success experienced at NAWCAD has brought about a bottom-up review of their financial management processes by NAVAIR who is currently modeling their financial management operations after Competency 7.6 operations (Rhodes, 2000).

a. Analysis of Competency 7.6 and CAO

There was a consensus among those interviewed that the CAO concept enabled the financial management processes to be used effectively in meeting customer requirements. Under CAO, employees work independently for teams or other competencies without direct supervision from their competency supervisors. By eliminating this layer of management, Competency 7.6 members felt that working as team members at program sites allowed them to use their financial knowledge and skills more on independently. This encourages team members from each competency to contribute to their team processes by challenging, recommending and improving those processes used. There was a complete buy-in by the employees to push their thinking beyond the boundaries and layers of their organizational department.

Before CAO, NAWCAD organizational structure operated as a functional and geographical entity. Lacking integrated IT systems that spanned all levels of NAWCAD, each department operated as a single entity. This lends itself to non-optimizing sub-systems that do not contribute positively to the whole organization. One example was the mid-level managers who focused on transactional management instead of a decision-based management and contributed little to the organization.

Those interviewed that worked under both systems prefer the CAO structure because there was a sense of empowerment for employees who were assigned to teams.

Under the CAO concept, employees can operate autonomously within the team applying their specific skill set. This suggests that the employees are fairly independent and therefore have a higher satisfaction with their work.

I. SUMMARY

Since 1994, NAWCAD has operated as a Competency Aligned Organization. The competencies are the foundation for NAWCAD to maintain and improve the technical resources and capabilities in an era of budget constraints and cost reductions. Setting the standard for other NAVAIR organizations to follow, NAWCAD's use of CAO has improved quality and efficiency, while incorporating continuous improvement throughout the organization (Dyer, 1999).

V. NAWCAD FINANCIAL MANAGEMENT STUDY FINDINGS

A. PRIMARY FOCUS OF STUDY

The primary focus of this chapter is to document existing financial management processes currently used at NAWCAD and how they will be integrated into an ERP program. In reviewing current processes, a historical perspective will assist in analyzing the ability for these processes to be adapted to an ERP environment. Data for this thesis were primarily obtained by interviewing comptroller employees involved with the financial management systems at NAWCAD. A list of the questions used for the interview is provided in Appendix A. Other sources of data include interviews with Financial Systems (Competency 7.6.5) employees as well as observations of the financial management system capabilities.

B. NAWCAD FINANCIAL OPERATING PRACTICES

From a financial standpoint, NAWCAD operates similarly to a commercial organization with one exception. Because it is a Navy Working Capital Fund (NWCF) activity, NAWCAD must operate on a break-even basis. They must charge the customer the price of products and services only – there is a zero profit motive. The NWCF is a financial accounting system that recognizes the total cost of goods produced and services provided. NAWCAD uses the NWCF financial management system of double entry accrual accounting and its budgeting is done on the basis of accrued costs when determining these costs (NAWCAD Compendium, 1999). Under this accounting system, labor (direct and overhead), non-labor costs, capital investments and costs are a prorated part of the rate structure. This rate structure is a measurement of efficiency. Therefore, financial management effectiveness

is measured by rate changes; the lower the rate the more efficient a NWCF activity is perceived. Figure 5.1 illustrates the cycle of NWCF operations involved at NAWCAD.

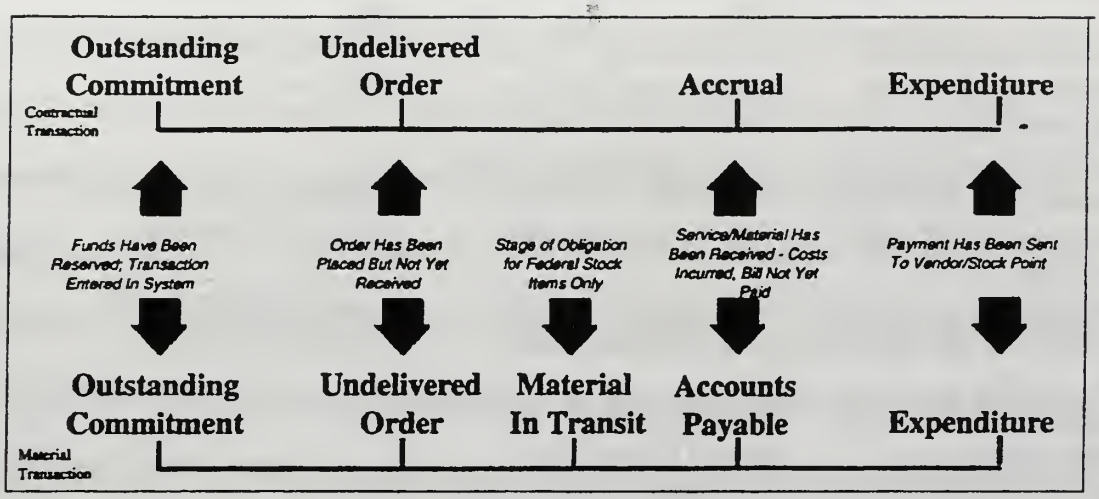

Figure 5.1 NWCF Financial Transaction Life Cycle
(NAWCAD Compendium, 1999)

In FY1995, Major Range Test Facility Base (MRTFB) funding became the responsibility of NAWCAD when Naval Air Station Patuxent River aligned itself (now Competency 8.0) with NAWCAD. MRTFB funds are overhead costs that support testing and evaluation and are financed by institutional funds, which are associated with research and development appropriations.

The Expense Operating Budget (EOB) is another type of funding that covers overhead expenses. Implemented in FY1997, EOB uses a combination of indirect funds for overhead expenses and direct funds (O&M,N) for production and administrative rates (NAWCAD Compendium, 1999). Table 5.1 is a comparison of EOB, NWCF and MRTFB - three major funds that NAWCAD deals with in its financial management processes.

NWCF	MRTFB	EOB
Customers pay for non-labor direct program costs	Customers pay for non-labor direct program costs only	Customers pay for non-labor direct program costs only
Customers pay for direct labor through the direct stabilized labor rate (includes military NWCF)	Customers pay for direct labor through the direct stabilized labor rates (excludes military NWCF)	Customers pay for actual labor costs
Customers pay a share of production cost through production rate	Production costs funded with institutional dollars	Production costs funded with O&M,N dollars
Customers pay a share of the G&A cost through G&A rate	Production costs funded with intuitional dollars	Production costs funded with O&M,N dollars
Customers pay for use of aircraft through rates	Customers pay for use of aircraft through rates	N/A
Proficiency flights funded by institutional (overhead) dollars	Proficiency flights funded by intuitional (overhead) dollars	N/A
Participates in Capital Purchase Program (CPP) for investment items >$100K	Improvement and modernization funded with institutional dollars	Investment items funded with OPN dollars
Budgeted and managed at expense level	Budgeted and managed at obligation level	Budgeted and managed at obligation level

Table 5.1 NWCF, MRTFB and EOB Funds Comparison
(NAWCAD Compendium, 1999)

C. TRANSITION FROM NIFMAS TO DIFMS

NAWCAD is currently undergoing a change in its financial management structure (Business Systems Overview, 1999). Replacing the open architecture Naval Information Financial Management System (NIFMAS), NAWCAD is implementing the Defense Information Management System (DIFMS) with transition completed in April 2000.

1. NIFMAS Financial Management System

NIFMAS had been NAWCAD's financial management system since the 1970s. Until 1993, NAWCAD operated NIFMAS with a COBOL system that was incompatible with the desire to have an open architecture based system. Hindrance was due to limited on-line interactive capability. For example, data input via keypunch systems and data output was done on an interval basis with limited batch-processing cycles. In October 1993, using Oracle based commercial off-the-shelf (COTS) software; the Business Financial Systems Department (Competency 7.6.5) designed an updated version of NIFMAS to accurately track, on a real-time basis, the financial operations and accounts throughout NAWCAD. With the change, NIFMAS was able to track internal and external budgets, accounting and resource execution, budget system process oversight, and provide resource reports and analysis.

Designed as a single point entry system, NIFMAS provided management reports with details at the transaction level. NIFMAS was re-engineered in 1994 to support NAWCAD's competency alignment; financial information was now sent directly to teams, eliminating a layer of management at the Operations Department level (Rhodes, 2000). At the cost center level, a history of transactions was now available for each team and competency. Working within an open architecture information system, all data were available to each competency for their use. NIFMAS allowed NAWCAD to integrate its financial management system with other legacy systems (Haggerty, 2000). Figure 5.2 illustrates the "past" business model utilized at NAWCAD and the interaction capability NIFMAS had with its business processes. Each process (Travel, Labor, Funding, etc.) had its own stand-alone system either mandated by DoD or developed in-house. Appendix B defines the acronyms used in Figure 5.2 and if they are NAWCAD or DoN/DoD generated.

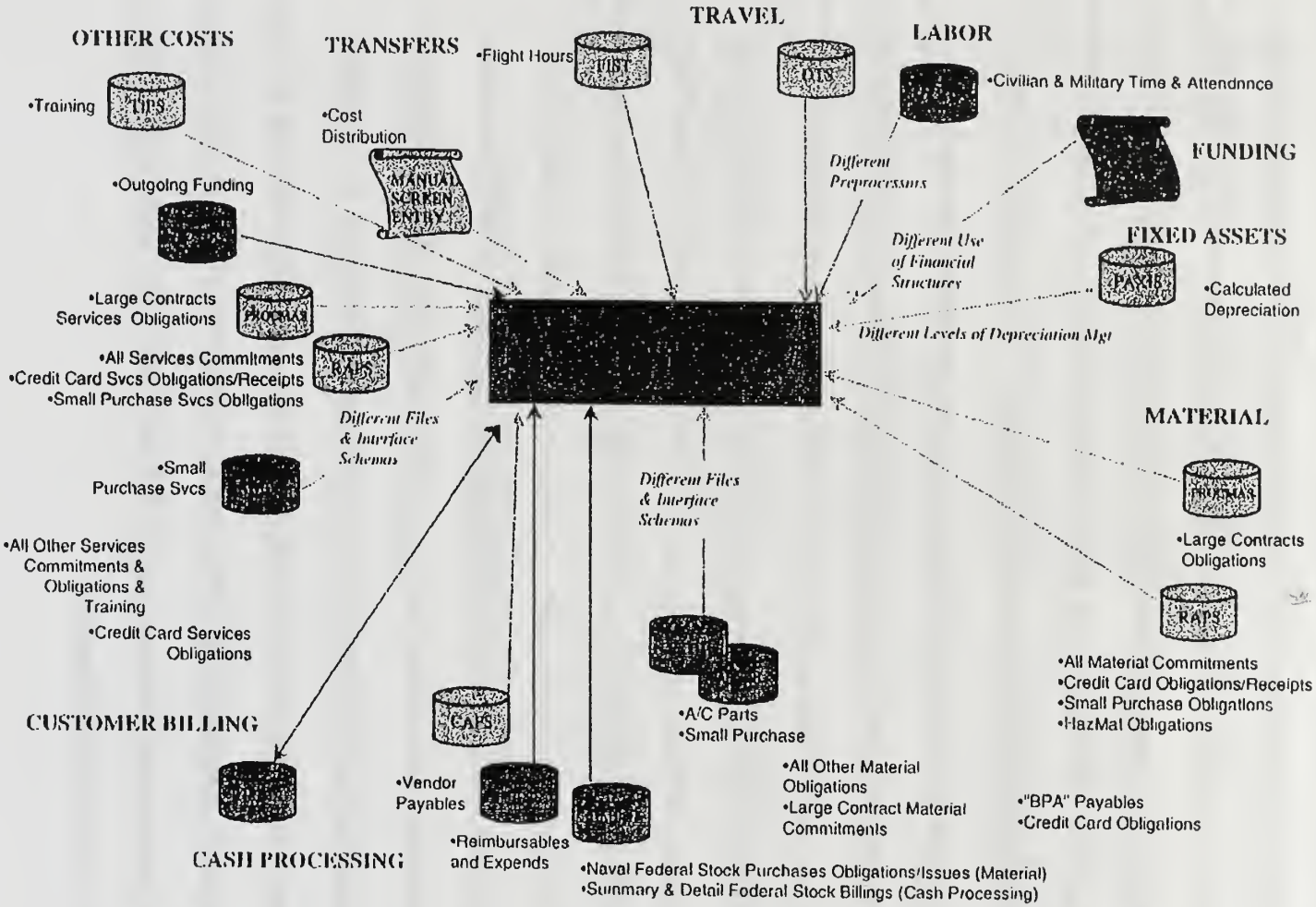

Figure 5.2 NAWCAD Operating Practices under NIFMAS
(Business Systems Overview, 1999)

2. DIFMS Financial Management System

In the early 1990s, DoD initiated a program of financial management reform. The goal was to standardize finance and accounting procedures and to reduce the cost for finance and accounting support services. DoD tasked the newly formed Defense Finance and Accounting Service (DFAS) with implementing financial management reform. (Business Systems Overview, 1999). Out of this reform DIFMS was developed.

Initially, DIFMS was developed for the Naval Aviation Depots (NADEP) as an accounting system. It was installed on the remote Defense Information Systems Agency (DISA) UNISYS mainframe in San Antonio, Texas and incorporated a hierarchical data structure with COBOL application programs. In 1994, the Defense Working Capital Fund Corporate Board recommended DIFMS as an interim migratory system for NAWCAD as part of the DFAS reform initiative (Business Systems Overview, 1999). Consequently, NAWCAD was directed to use DIFMS and implementation was complete in April 2000. Figure 5.3 represents the "as is" business model that NAWCAD is currently using with its financial management processes. Appendix B defines the acronyms used in Figure 5.3 and if they are NAWCAD or DoN/DoD generated.

A major difference between DIFMS and NIFMAS is now NAWCAD is unable to implement software changes. NAWCAD can only request its changes through DISA, who is responsible for programming, implementing and maintaining the system. Another difference between DIFMS and NIFMAS is the workload increase necessary to obtain data and reports. DIFMS process transactions require more manpower and checks for accuracy is limited (Business Systems Overview, 1999). Once data are entered automatically via each process system, NAWCAD loses the ability to manually update or correct data.

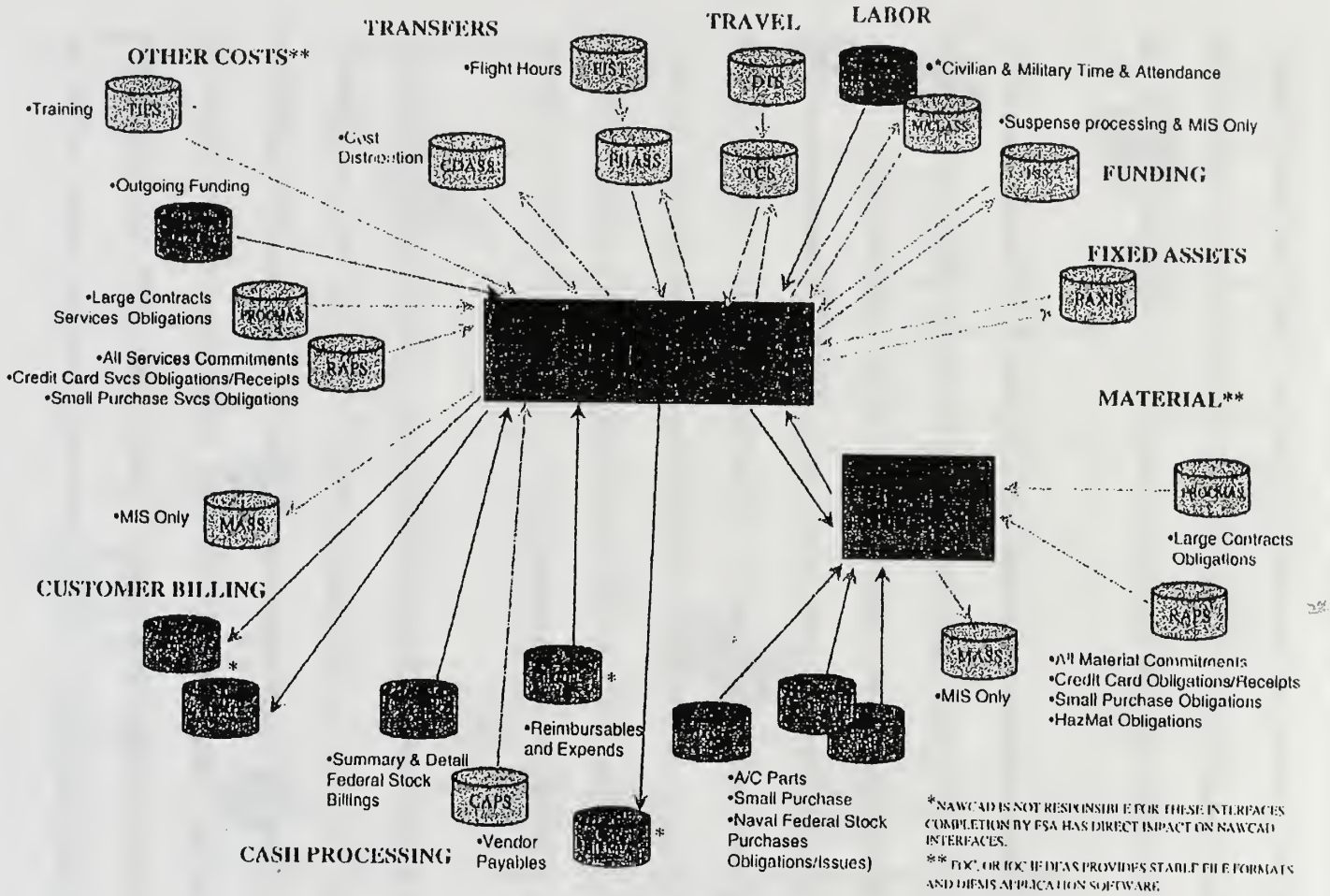

Figure 5.3 NAWCAD Operating Practices under DIFMS
(Business Systems Overview, 1999)

Instead, it has to query DIFMS for the information before it can correct the inputs. The lack of real-time interface also is problematic with DIFMS. While data can be viewed on a real-time basis, it is inapplicable for use in NAWCAD's financial processes. For example, payroll data can be polled for viewing only on a real-time basis. However, it takes approximately 10 days for the data to be applied to the Standard Labor Data Collection and Distribution Application (SLCADA) system in a format that can be analyzed for accuracy and budgeting (Rhodes, 2000).

3. Transitional Changes from NIFMAS to DIFMS

The transition from NIFMAS to DIFMS changed the way budget responsibility for overhead costs are shown. With DIFMS, the transfer of overhead expenses (such as MRTFB costs) is no longer possible among the competencies as it was with NIFMAS. Instead, costs for services provided by a competency must be accounted for by both the performer and benefiting competency, creating double accounting transactions. The weakness inherit in this system is it requires more time than with NIFMAS and could lead to error caused by multiple data inputs. Until DIFMS is capable of providing the necessary information NAWCAD-wide, an interim solution has been put in place called Consolidated Aircraft Division Financial Information Reporting System (CADFIRS) (NAWCAD Compendium, 1999). CADFIRS is a single source data warehouse capability used by each competency. The functions of CADFIRS are to provide weekly snapshots of financial data across the NAWCAD claimancy in support of the financial management needs of competency managers and team leaders. Competency managers use the information for cost center reports and financial performance reports based on current budget year data. Team leaders use the data for current program year data involving funds status reports.

D. RESULTS AND ANALYSIS OF INTERVIEWS

Each Competency 7.6 team member interviewed expressed a general feeling of dissatisfaction with DIFMS in the context of it not providing the information that NIFMAS provided. All stated it was a system with limited capabilities in providing the information they needed on a day-to-day basis.

1. DIFMS Application on NAWCAD Financial Management

As DIFMS comes on line, capabilities of Competency 7.6 that were present with NIFMAS are no longer apparent. These include the ability to analyze cost data, produce real-time reports and access links to other NAWCAD processes for shared data. Two solutions are in place to help alleviate these problems. They are the use of independent software solutions informally called "sideshow" or "stealth" solutions and a Competency 7.6.5 developed solution known as Business Objects.

a. Sideshow Solution

In order to analyze the costs involved and produce real-time reports requested by upper management, manual intervention occurs with the use of programs (often Excel based) that require additional unfunded man-hours. These programs also allow each competency manager and team leader to have access to current data concerning their financial status. Interviewees described these programs as a requirement, once NIFMAS went away, for keeping current on budget execution and funds status.

b. Business Objects Solution

Because DIFMS does not provide the same information that NIFMAS generated, Competency 7.6 uses a patch called Business Objects to retrieve information that

was automatically generated by NIFMAS (Business Systems Overview, 1999). Business Objects gives managers the ability to retrieve data for *ad hoc* reports by allowing them to download data from corporate systems (bypassing DIFMS). Based around a client server environment, Business Objects provides the capability for users to generate their own reports and to download data for use in other software or systems.

Separate interviews were conducted with the Business Financial Systems Requirements Division (Competency 7.6.5) that is responsible for designing the IT requirements used for tracking the FM processes throughout NAWCAD. System analysts within Competency 7.6.5 stated the department was capable of aligning their system to accommodate any change due to mandated systems. However, the Competency 7.6.5 director indicated that his department had experienced a considerable increase in workload in accomplishing these tasks. Currently, Competency 7.6.5 is updating the IT system to work with DIFMS by supplying the same financial information to NAWCAD competency and team members they once received from NIFMAS.

*c. **Analysis of DIFMS Application***

With DIFMS, Competency 7.6 accountants cannot determine NAWCAD's financial status until the previous month is closed out. As a result, there is a 30 to 60-day delay in the billing process for accounts receivable. This situation prevents monthly reports from being generated real-time, unlike what occurred under the NIFMAS program. As of March 2000, DIFMS has not provided any financial reports that show current budget execution.

Several fixes have been developed to counter these problems, but these require unfunded man-hours (Robrecht, 2000). Budget and program analysts work harder, inputting redundant data in different systems, in order to generate reports that were automatically produced under NIFMAS.

Another weakness concerning DIFMS is the costs involved. Not only does DIFMS produce less real-time information for managers at the competency and team level, it is more expensive to operate than NIFMAS. DIFMS costs $860,000 per year to operate and $500,000 a year in maintenance costs, while NIFMAS total costs (as a proprietary system) were $500,000 (Haggerty, 2000). Additional fees are charged on a "per use" basis. For example, under NIFMAS, a billing invoice costs $29 to produce, but with DIFMS, that same invoice cost is determined by a $16.77 per line item total. All invoices will exceed the $29 cost under NIFMAS because of their multiple line item entries (Foley, 2000). These extra costs place a burden on the NWCF, they must charge the customer more in per hour costs to recoup the non-value added expenses.

E. SUMMARY

Under NIFMAS, each competency and team could generate an array of reports from any data available. While not considered an ERP system, its characteristics were similar because it had in place the integrated systems to enable the cross-functional communication, facilitation and data sharing that occurs in an ERP system. With DIFMS, these ERP characteristics disappeared and managers have developed independent IT solutions referred to as "sideshow' or "stealth" programs. NAWCAD has also regressed in their financial

management systems capability, from an open systems real-time environment to a batch processing COBOL mainframe environment.

NAWCAD is gearing their IT to address the issues of providing support to their competencies and teams. This is being accomplished by using Business Objects to develop a*d hoc* reports and developing a warehouse data structure to eliminate the current redundancy needed to prepare reports and analysis. NAWCAD is also designing the financial management system to integrate with the ERP system currently being studied by NAVAIR.

VI. IMPLEMENTING ERP INTO FINANCIAL MANAGEMENT OPERATIONS

A. BACKGROUND OF THE STUDY

> *DoN will use best business practices (commercial or public) and supporting architectures (ERP approach) to make informed decisions (right information to the right people at the right time). (ERP Overview Briefing, 2000)*

The goal of the Navy in implementing ERP is to:

- Have financial management information be an automatic by-product of the ERP process.
- Standardize business processes – one set of books.
- Know the cost drivers and relate the costs to value.
- Maintain public trust in the DoN financial management.

Currently, NAVAIR is implementing an ERP pilot program using E-2C aircraft program management data. The pilot program will include participation from NAVAIR, NAS North Island, California (E-2C aircraft are reworked at Naval Aviation Depot [NADEP]), NAS Patuxent River, Maryland and Orlando, Florida. The pilot project will focus on acquisition, financial configuration and asset management functions of an ERP system. The ERP pilot represents the first step toward providing NAVAIR program managers with accurate, real-time information in one integrated system. The results of the pilot will assist in preparation for TEAM-wide deployment of ERP, which is scheduled to begin in 2001 (Lockard, 2000). Using a "wave deployment" approach (Figure 6.1), ERP will be implemented NAVAIR-wide. This will occur over a four-year period with the first year for pilot studies and the last three for full implementation.

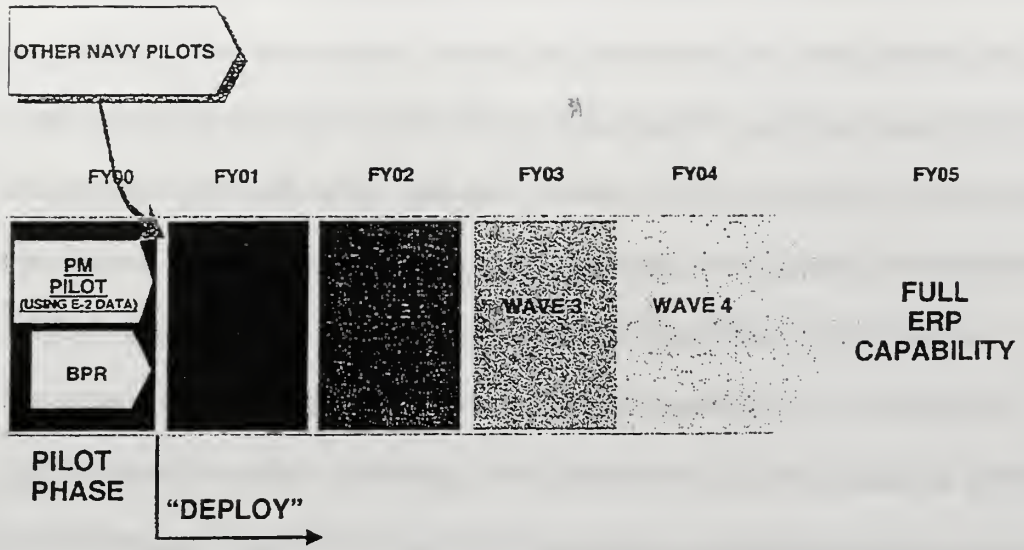

Figure 6.1 NAVAIR ERP Deployment
(ERP Overview Briefing, 2000)

B. NAVAIR ERP STUDIES OF FINANCIAL MANAGEMENT PROCESSES

NAVAIR chose the Gartner Group as consultants to their ERP program management pilot project. Among the areas of focus in the project were the compatibility issues concerning NAVAIR business processes and ERP implementation. The Gartner Group did a *preliminary* study on processes involving acquisition, production, workload and business development. Based on the processes chosen, themes addressed were asset, work, and project management, logistics, scheduling, work flow and finance. The Gartner Group developed 14 themes present in the finance processes and applied them to NAVAIR to determine a level of compatibility with current ERP systems in the commercial sector. Six of the 14 (see Table 6.1) studied are applicable to Competency 7.5 operations. The ability for these processes to fit within the core business processes varied from easily obtainable to difficult. Table 6.1 lists the six themes and their strength in ability to fit. Three of the six

themes meet the "traditional" ERP systems fit, while the remaining three require adjustment. With this information, NAVAIR conducted a gap analysis. A gap analysis can be defined as how the ERP provider will close the gap between standard ERP functionality and NAVAIR's (or NAWCAD) business processes. The provider must demonstrate the ability to align their solution with either existing or newly engineered processes. Included in the analysis is whether a business process requires modification and if so, to what extent. Traditional ERP systems are designed for product-centric organizations or ones that manufacture a product. NAVAIR is an asset-centric or a service-oriented organization. (Gartner Group, 1999). There exists a significant difference between NAVAIR business processes and traditional ERP compatibility. The data indicates there is no single application ERP suite that will address the financial management processes within NAVAIR.

Theme	Description	ERP Strength
Asset Management	Tracking, History, Accounting, Configuration on Assets	Medium
Procurement	Contracts, Procurement Modes	High
Project Costing/Accounting	Costing, Planning, Forecasting, Accounting	High
Budget Management	Multiple Levels, Multiple Versions, Taxonomies	High
Contractor Integration	Human Resources, Accounting, Process Flow, Information Sharing	Medium
Decision Support	Data Calls, Planning, Analysis (Contracts, Contractors, Assets)	Medium

Table 6.1 ERP Levels of Fit with NAVAIR Gap Analysis
(Gartner Group, 1999)

A *preliminary* study of data, defining processes on a TEAM level, was used in the Gartner analysis to understand the difficulty of implementing ERP within NAVAIR and NAWCAD. Appendix C lists 13 processes and compliance with and expectations of traditional ERP implementation. (Gartner Group, 1999) Ten out of 13 processes reviewed were adaptable to a standard implementation. The remaining three required a bolt-on solution of which two were unlikely candidates for ERP implementation.

When implementing ERP, business processes used by the DoN, DoD and contractors can contribute to NAVAIR's complex financial management practices (Gartner Group, 1999). NAVAIR must be flexible when dealing with mandated and legacy systems and if possible obtain waivers for systems that can affect best practices. Examples are: mandated systems such as DIFMS, unique funding characteristics of the MRTFB, EOB and NWCF, and regulatory or policy constraints from outside controlling agencies.

C. RESULTS AND ANALYSIS OF INTERVIEWS

Each competency representative was questioned about ERP and its integration into his or her competency and NAWCAD. All stated an ERP system must have a financial management solution that can eliminate the legacy and sideshow systems in order for information to flow freely throughout NAWCAD. The representative from Competency 7.0 stated ERP could help with seamless data exchange between national financial and data management systems such as Naval Aviation Logistics Command Management Information System (NALCOMIS), which uses different files and interface schema, and internal NAWCAD systems. Currently, a manual interface is necessary to

accommodate NALCOMIS with DIFMS, requiring duplicate data entries, leading to possible error.

The responses to ERP implementation were minimal due to its newness. Each competency understood the implications of ERP and all agreed it would be an improvement over DIFMS. Competency 2.0 is studying ERP implementation from a perspective of assessing future electronic acquisition initiatives across the NAVAIR TEAM spectrum. Their goal of reduced overhead and reduced billing rates to customers is envisioned as a result of ERP. At the time the interviews were conducted, limited information from other competencies was available.

1. Analysis of Interviews

The responses to ERP questions from those interviewed were mostly general in nature. Because ERP is in a pilot stage, specifics surrounding implementation were not yet available. Instead their responses were directed towards the benefits ERP would bring, especially in the area of making DIFMS more responsive to their needs. Each competency is aware of their role in the ERP process, but to what extent has not been determined. Once implementation begins, training should eliminate that factor. All interviewees realized NAWCAD needed to continuously change to maintain their uniqueness. Only two competencies (2.0 and 7.0) were able to provide specifics on ERP implementation. All competencies were in agreement that DIFMS would serve NAWCAD better if completely removed and replaced with a NIFMAS-like ERP system. However, it is apparent that NAWCAD is constantly seeking better ways to carry out their mission. For instance, Competency 7.5 constantly seeks cutting edge technology to enhance its financial management capabilities.

D. SUMMARY

NAWCAD has positioned itself as a likely candidate for successful ERP implementation. Competency and team members are familiar with ERP concepts from the Oracle-based NIFMAS financial management information system. Even with DIFMS, NAWCAD is developing a migratory IT system that will be compatible with ERP technology and software.

Too often, organizations fail to recognize that ERP implementation involves people as well as technical systems. NAWCAD has overcome this hurdle with previous change-management mechanisms involved with NIFMAS and CAO implementation. There was not any apparent reason to think they would encounter any problems with Navy-wide ERP implementation. Already under development, NAVAIR's change-management plans, readiness assessment, and communications and training are in-sync with the WAVE deployment plan (ERP Overview Briefing, 2000). NAWCAD experience with ERP-type processes should allow for a seamless transition from a change-management perspective.

VII. SUMMARY CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

In response to Defense Reform Initiative, the Department of Defense (DoD) has accepted the challenge to become more efficient and effective in their business processes. The Department of the Navy (DoN) has decided to use ERP, Enterprise Resource Planning as a foundation for change in their business practices. This thesis examined the financial management process within the framework of future ERP implementation at the competency aligned NAWCAD, Naval Air Warfare Center Aircraft Division. The conclusions are based upon interviews and data collected.

With the Defense Information Financial Management System (DIFMS), the financial management processes are no longer able to share common data across the organization as with the Naval Information Financial Management System or NIFMAS. Also, NAWCAD no longer has the same capability to access information in a real-time environment as with NIFMAS. Once NIFMAS was replaced by DIFMS, it became apparent that the financial management processes digressed in its capabilities and output. By implementing ERP, NAWCAD will once again standardize its business applications and information systems while eliminating legacy systems and mandated high cost systems. This thesis supports the implementation of ERP into the NAWCAD financial management processes.

B. RESEARCH QUESTIONS

1. What are the existing financial management processes currently used at NAWCAD that will be incorporated in implementing ERP? NAWCAD is

currently using the NWCF, Navy Working Capital Fund, financial accounting system under the DIFMS system. Integrated with DIFMS are multiple legacy systems that provide financial information to internal and external stakeholders. Currently, these systems are undergoing a migratory transition to accommodate DIFMS for future ERP implementation.

2. **What are the major drivers for implementing ERP?** NAWCAD is seeking to modernize its financial management processes and information systems to provide the information needed in an integrated environment with an enterprise-wide view. ERP technology will enable NAWCAD management the ability and flexibility to redesign the existing processes to be more in line with best commercial practices. ERP will help avoid the lower effectiveness brought about by using aging legacy systems, such as DIFMS, that do not provide efficient industry and government best practices.

3. **Will there be any major impediments to implementing ERP?** Discussion in Chapters V and VI indicates that the major impediment to implementing ERP will be the incorporation of mandated systems such as DIFMS. Identified in a gap analysis by the Gartner Group, other financial management processes considered difficult to implement have been studied under NAVAIR's pilot program. For example, contract writing and management and planning for the MRTFB budget are processes that would need to be modified significantly and/or require a bolt-on solution.

4. **What processes are involved with ERP implementation?** Ross (1999), wrote extensively on implementing ERP into an organization. She divided the implementation process into five chronological steps: design, implementation, stabilization, continuous improvement and transformation. As NAWCAD considers

ERP, it is important they understand that performance will temporarily get worse and resistance to change will occur as ERP is implemented.

5. **How can NAWCAD benefit from ERP case studies on commercial and government organization?** Analysis of commercial and government organizations that implemented ERP in Chapter II specifically cite cases that would benefit NAWCAD. Similarities exist between Boeing's McDonnell Aircraft And Missile Systems and NAWCAD in terms of product output and research and development. McDonnell's Integrated Manufacturing Control System (IMACS) represents the type of technology that NAWCAD could study for possible implementation into their organization. The success in implementing IMACS was due to the use of client-server systems over a mainframe system and commercial-off-the-shelf technology. McDonnell started with processes, not the systems. Using a process-based methodology, McDonnell documented all key processes and then applied best practices.

NAWCAD and the DoN should study other governmental agencies' ERP implementation processes. The U.S. Mint's elimination of its legacy systems allowed the Mint to avoid costly customization packages. Working with a full-scale ERP package, the Mint was also able to go live in less than a year. DoN should study the possibility of eliminating out-dated legacy systems such as DIFMS based on the Mint's ERP implementation.

C. CONCLUSIONS AND RECOMMENDATIONS

Based on the research and findings of this thesis, the following conclusions and recommendations are offered to help NAWCAD improve their financial management capabilities.

1. Conclusions

NAWCAD's Competency Aligned Organization structure could support an ERP implementation.

As one of the major commands to completely implement competency alignment successfully, NAWCAD has set the standard for innovation in the Navy's business process re-engineering program. ERP solutions rely on organizational commitment along with the hardware and software products for successful implementation. ERP fits well with an organization, such as NAWCAD, which shows a capability to handle organization change successfully.

An ERP implementation will eliminate or improve current legacy-based financial management systems.

ERP technology will enable NAWCAD to redesign current business processes to be more in line with current best business practices. ERP will help reduce the lower effectiveness brought about by the use of aging legacy systems that cannot adapt to best practices of commercial and government organizations. ERP is also likely to be a means to address the issue of continuing reduced budgets. It provides NAWCAD the flexibility and ability to re-engineer business processes to reduce costs. Bolt-on solutions could provide the necessary connecting infrastructure to incorporate mandated systems such as DIFMS with an ERP solution.

Presently, NAWCAD's financial management processes are performed by the DIFMS, with inputs from internal and external legacy systems. However, DIFMS has limitations that do not provide NAWCAD with existing business processes that are in line with today's best commercial practices. Preliminary studies by the Gartner Group

have documented these processes and their adaptability to an ERP implementation. This study or gap analysis determines the compatibility issue of implementing the ERP financial management modules to replace current legacy systems.

Industry and government ERP implementations can provide helpful insight for NAWCAD ERP implementation.

The Department of Navy and NAWCAD would benefit from studying private industry as well as government organization's ERP implementation. As the Navy reforms its financial practices based on proven commercial practices, the availability of information to assess ERP implementation is increasing. The use of these best practices in similar organizations can benefit the Navy and NAWCAD.

2. Recommendations

Enhance NAWCAD's financial management capability.

Ultimately, replace DIFMS as the financial management information system and replace it with one that is compatible with an ERP implementation. An ERP financial module should provide the necessary information to the Department of Navy (DoN) management and to all NAWCAD management levels. The NAWCAD management metrics should be clearly related to day-to-day business decisions, while the metrics should focus on organizational cost and effectiveness at the activity level.

Continue developing a migratory information system to incorporate the current legacy systems with DIFMS and the future ERP implementation.

This approach should involve the connecting infrastructure of ERP implementation that represents the communication layer between commercial off-the-shelf software, mandated legacy systems and NAWCAD data warehousing capability.

Competency 7.6.5 should continue to develop their data-warehousing program to accommodate both DIFMS and ERP.

Study ERP implementations at commercial and government organizations.

NAWCAD could benefit from studying the ERP implementation at Boeing's McDonnell Aircraft and Missile Systems. Similarities exist between both organizations in terms of product output and the associated research and development. McDonnell's Integrated Manufacturing Control System (IMACS) represents the type of technology that NAWCAD could study for possible implementation into their organization.

NAWCAD and the DoN should study other government agencies' ERP implementation processes. The U.S. Mint's elimination of its legacy systems allowed the Mint to avoid costly customization packages. Working with a full-scale ERP package, the Mint was able to go live in less than a year. DoN should study the possibility of eliminating out-dated legacy systems such as DIFMS based on the Mint's ERP implementation.

3. Further Research

This study of the current financial management processes at NAWCAD has provided the groundwork for a follow-up study of the same processes under an ERP-based financial management system. Further studies will be able to reference this study to compare and contrast the processes that Competency 7.5 uses following ERP implementation at NAWCAD.

APPENDIX A

COMPETENCY 7.6 INTERVIEW QUESTIONS

1. How are these processes involved in your competency?

    a. Financial Management
    b. Procurement
    c. Asset Management

2. Are the processes different at the competency level and program team level?

3. How often are the processes reviewed for revision?

4. What IT solutions are applied at the competency level?

5. Do the IT solutions cross competencies, or are there barriers?

6. Will ERP implementation affect your competency?

7. What do you expect from implementing ERP?

8. Do you have a strategic plan regarding your competency?

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APPENDIX B

GLOSSARY OF ACRONYMS FOR FIGURES 5.1 AND 5.2

FUNDS TRANSFER SYSTEMS

CDASS – Cost Distribution Rated Service Accounting System – NAWCAD
FHASS – Flight Hour Subsystem – NAWCAD
FIST – Flight Information Scheduling – NAWCAD

TRAVEL SYSTEMS

DTS – Defense Travel System – NAWCAD
TCS – Travel Cost System – NAWCAD

LABOR SYSTEMS

M/CLASS – Military and Civilian Labor Subsystem – NAWCAD
SLCADA – Standard Labor Data Collection and Distribution Application – DoN/DoD

FUNDING SYSTEMS

FSS – Funding Subsystem – NAWCAD

FIXED ASSETS SYSTEMS

PAXIS – Patuxent River Inventory – NAWCAD

SYSTEM MATERIALS

NALCOMIS - Naval Aviation Logistics Command Management Information – DoN/DoD
UADPS – Uniform Automated Data Processing System – DoN/DoD

CASH PROCESSING SYSTEMS

APADE – Automation of Procurement/ Accounting Data Entry – DoN/DoD
CAPS – Commercial Accounts Payable System – NAWCAD
STARS – Standard Accounting and Reporting System – DoN/DoD
IFCDRS – Industrial Fund Collections/ Disbursing Reconciliation System – DoN/DoD

CUSTOMER BILLING SYSTEMS

FRS – Financial Reporting System – DoN/DoD
HCM – STARS Headquarter Module – DoN/DoD

OTHER COSTS SYSTEMS

FOSTR – Funds Off Station Transfer – DoN/DoD
MASS – Material Subsystem – NAWCAD
PROCMAS – Procurement Contracts Monitoring Automated System (Competency 2.0 use PROCMAS for award of contracts. CMAS used by customers after contract is awarded) – NAWCAD
RAPS – Requisition and Processing System – NAWCAD
TIPS – Training Information Processing system – NAWCAD

APPENDIX C

NAVAIR GAP ANALYSIS

Title	Description	ERP Backbone Expectation	Compliance
Financial Management	Perform Managerial Accounting; Prepare Financial Status Reports; Manage Civilian Payroll; Perform budget formulation and execution for Corporate/Competency/Site.	H	4
Perform Managerial Accounting	Process accounting transactions which includes preparing financial statement executive summary, process civilian payroll (includes DFAS), develop accounting system interfaces & related systems, correcting exception/suspended transactions, accrual of transactions, processing miscellaneous disbursements, financial analysis, financial projections, fixed asset management, COR for DFAS accounting services.	H	4
Perform Corporate/ Competency/ Site Budgeting and Funds Execution	Formulate/Modify/Update Corporate/Competency/Site Budget; Execute Corporate/Competency/Site Budget; Defend Corporate Budget; Develop Customer Rates; Accept funding documents; prepare funding document; monitor direct and indirect execution; prepare recurring and special fund status reports; manage billing of funded work.	H	4
Perform Corporate/ Competency/ Site Workload Planning Mgmt	Provide workload management analysis; determine requirements, develop resources, submit estimate; execute workload to determine budget Forecast workload; track workload; collect, compile, analyze & validate corporate/competency/site planning data in order to provide workload & resource management information. Monitor workload execution plan.	M	3
Perform Budgeting for Government Development & Production	Estimate program costs, formulate/modify/update program budgets, estimate program budgets. Perform/support the formulation of program budgets; Perform/support the update/modification of program budgets; Execute program budgets, including preparation and staffing of all financial documents; Perform/support program cost estimating (this does not include the formal Independent Cost Estimate (ICE); Respond/support budget drills and data calls; Systematic upkeep and reconciliation of program budgeting and accounting data; and Budgeting for organic and contractor support personnel required for program acquisition management; Perform FMS case financial management, reconciliation, and closure.	H	4
Perform Business Development Activities with non-NAVAIR Customers	Participate in trade shows, air shows, and industry associations; Participate in discussions/meetings with potential FMS, industry, and other Government customers; Solicit potential funding sources for technology development projects; Develop marketing plans/hand-outs.	M	2
Perform ISE/LS Budgeting & Funds Execution	Perform/support the formulation of ISE/LS program budgets; Perform/support the update/modification of ISE/LS program budgets; Execute ISE/LS program budgets, including preparation and staffing of all financial documents; Respond/support budget drills and data calls; Systematic upkeep and reconciliation of program budgeting and accounting data; Budget for organic and contractor support personnel required for ISE/LS.	H	4

Continued on next page

Perform Repair & Mod Budgeting	Perform/support the formulation of Repair & Mod program budgets; Perform/support the update/modification of Rep & Mod program budgets; Execute program budgets, including preparation and staffing of all financial documents; Perform/support T&E program cost estimating (this does not include the formal Independent Cost Estimate (ICE); Respond/support budget drills and data calls; Systematic upkeep and reconciliation of program budgeting and accounting data; and Budgeting for organic and contractor support personnel required for program acquisition management; Perform FMS case financial management, reconciliation, and closure.	H	4
Perform MRTFB Management & Planning	Activities related to the overall management of the MRTFB budget including investment planning for development/upgrade of T&E facilities to meet emerging T&E requirements.	L	2
Perform/ Support Program Budgeting and Funds Execution	Perform/support the formulation of program budgets; Perform/support the update/modification of program budgets; Execute program budgets, including preparation and staffing of all financial documents; Perform/support program cost estimating (this does not include the formal Independent Cost Estimate (ICE); Respond/support budget drills and data calls; Systematic upkeep and reconciliation of program budgeting and accounting data; and Budgeting for organic and contractor support personnel required for program acquisition management; Perform FMS case financial management, reconciliation, and closure.	H	4
Provide Assessment/ Guidance for Contractor Cost/ Schedule Performance	Assess/analyze cost/schedule performance reports, schedules, etc.); Participate in meetings/reviews with contractor related to cost/schedule performance.	M	3
Conduct Proposal Evaluation, Contract Negotiation and Award Activities	Prepare solicitation; Evaluate proposals (includes source selection and cost analysis); Perform negotiation; Perform documentation; Perform award functions.	L	2
Develop Initial Program Cost Estimates/ Budgets	Develop initial program cost estimates and budgets; Coordinate with program sponsor regarding program estimates/budgets; This activity is the upfront cost estimating/budgeting to establish program—once established, budget updates, management, and funds execution is allocated to "Perform/Support Program Budgeting and Funds Execution" activity.	H	4

DEFINITIONS

Compliance

5 = The NAVAIR process would be easily automated by a standard ERP implementation.
4 = The NAVAIR process needs to be modified (slightly to implement the ERP package.
3 = The NAVAIR process will be automated via an ERP implementation that includes "bolt-on" applications.
2 = The NAVAIR process would need to be modified significantly and ERP implementation would include bolt-on solutions.
1 = No compliance between the NAVAIR process and an ERP implementation.

ERP Backbone Expectations

H (high) = This process is a strong and likely candidate to be included in the ERP implementation.
M (medium) = The process is a candidate to be included in the ERP implementation.
L (low) - The process is an unlikely candidate to be included in the ERP implementation

(Gartner Group, 1999)

LIST OF REFERENCES

Berg, Robert M. and Fauntleroy, J. Corbin, *A Brief History of the Enterprise Resource Planning (ERP) Efforts in the Revolution in Business Affairs (RBA)*, Center for Naval Analysis, Alexandria, Virginia, October 1999.

Bergey, John K., Northrop, Linda M., and Smith, Dennis B., *Enterprise Framework for the Disciplined Evolution of Legacy Systems*, Carnegie Mellon University, Pittsburgh, Pennsylvania, October 1997.

Boudette, Neal E., "SAP Acts to Head Off More System Problems," *The Wall Street Journal*, pp A25-A26, 04 November 1999.

Briscoe, Diane, M., Research and Engineering Customer Support, NAWCAD, Patuxent River, Maryland, Interview with the author, March 28, 2000.

Caruso, David, "Implementing ERP," *Intelligent Enterprise*, v. 2, pp 24-26, 20 April 1999.

Department of the Navy, *Revolution in Business Affairs Home Page*, [http://rba.hq.navy.mil/decision_goal/cbp_charter.html], October 1999.

Department of the Navy, "Incorporate Commercial Financial Practices Working Group Charter," [http://rba.hg.navy.mill/decision_goal/cdp_charter.html], October 1999.

Dyer, Joseph W., RADM, *Naval Air Warfare Center Aircraft Division Home Page*, [http://www.NAWCAD.navy.mil] 1999.

ERP Overview Briefing, Distler, Dennis, Enterprise Solutions Program Office, NAVAIR, Patuxent River, Maryland, February 04, 2000.

Flinn, T., "What is Enterprise Resources Planning?" [http://www.providence.edu/acc/pae/ais/student/flinn/flinn3.html], 1999.

Foley, Mike, Management Accounting Division – Comptroller Department, NAWCAD, Patuxent River, Maryland, Interview with the author, February 10, 2000.

Galliers, Bob and Swan Jackie, *Information Systems and Strategic Change A Critical Review of Business Process Re-engineering*, Rethinking Management Information Systems, Oxford University Press, New York, New York, 1999.

Gartner Group Engagement # 29011630, *ERP Initial Gap Analysis*, February 24, 1999.

Gibson, Nicola, Holland, Christopher P. and Light Ben, "Global Enterprise Resource Planning Implementation," paper presented at the 32nd Hawaii International Conference on Systems Sciences, Hawaii, 1999.

Haggerty, Richard, Business Financial Systems Requirements Division, NAWCAD, Patuxent River, Maryland, Interview with the author, April 13, 2000.

Hicks, Donald A., Stecke, Kathryn, E., "The ERP Maze: Enterprise resource planning and other production and inventory control software," *Industrial Engineering Solutions*, v. 27, pp. 12-16, August 1995.

Keller, E., "Making the Jump from MRP II To ERP," *Computer Integrated Manufacturing*, Gartner Group Publication R-345-107, July 5, 1991.

Knorr, Eric, "Despite 1999's slowdown, there's plenty of opportunity left.," *Upside*, v. 11, pp. 209-215, December 1999.

Little, D. and Yusuf, Y.Y., *Manufacturing Control Systems- Moving towards the Enterprise Model,* The University of Huddersfield, United Kingdom, The University of Liverpool, United Kingdom, April 1997.

Lochard, John A. VADM, *TEAM Objectives for 2000,* NAVAIR Strategic Plan, [http://www.navair.navy.mil/aboutus/our_vision.cfm], February 2000.

M2 Presswire, "PEOPLESOFT: DERA favours PeopleSoft over SAP and Oracle for GBP 18 million web-enabled ERP solution," *M2 COMMUNICATIONS LTD*, Coventry, United Kingdom, February 03, 1999.

Martin, Ray, "Turbocharging MRP II Systems," *Industrial Engineering Solutions*, v. 27, pp 32-36, November 1995.

Naval Air Warfare Center Aircraft Division (NAWCAD), *Business Systems Overview Brief*, February 10, 1999.

Naval Air Warfare Center Aircraft Division (NAWCAD), *NAWCAD Commercial Value Home Page*, [http://www.nawcad.navy.mil/nawcad/focus/commerce.html], 1999.

Naval Air Warfare Center Aircraft Division (NAWCAD), *Corporate Overview Home Page*, [http://www.nawcad.navy.mil/nawcad/information/home/ad_corp_ov.html], 2000.

Naval Air Warfare Center Aircraft Division (NAWCAD), *BEM Compendium*, Version 3, February 1, 1999.

Parker, Kevin, "A Stunning Success," *Manufacturing Systems*, v. 14, pp. 32-88. July 1996.

Perlman, Ellen, "Government Out of the Box," *Governing*, v. 12, pp. 65-70, July 1999.

Ptak, Carol A. and Schragenheim, Eli, *ERP Tools, Techniques, and Applications for Integrating the Supply Chain,* St. Lucie Press, Boca Raton, Florida, 1999.

Reyelts, E.L., *Utility of Enterprise Resource Planning for the Department of the Navy,* Master's Thesis, Naval Postgraduate School, Monterey, California, June 1999.

Rhodes, Alison, NWCF Business Execution and Analysis Division, NAWCAD, Patuxent River, Maryland, Interview with the author, March 27, 2000.

Ross, Jeanne, W. "Surprising Facts About Implementing ERP," *IT Professional*, v. 1, pp 65-68, July/August 1999.

Rowen, Miranda, "The rise of ERP technology in the public sector; enterprise resource planning," *Government Finance Review*, No.4, Vol. 15, August 1, 1999.

Robrecht, Patricia, Deputy Comptroller, NAWCAD, Patuxent River, Maryland, Interview with the author, February 10, 2000.

Violino, Bob, "Extended Enterprise," *Information Week Online*, [http://www.informationweek.com/726/coke.htm], March 22, 1999.

Varon, Elana, "U.S. Mint changes old Software for new Coins," *Federal Computer Week*, v. 12, p. 15, November 23, 1998.

Womeldorf, Tom, "Boeing enters new era in military aircraft production," *Manufacturing Systems*, v. 16, pp. 55-56, August 1998.

Zuckerman, Amy, "ERP: Pathway to the Future or Yesterday's Buzz?," *Transportation & Distribution*, v. 40, pp. 37-44, August 1999.

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